DOCUMENT RESUME

ED 240 264 CE 038 010

AUTHOR	Boyd, Chester; And Others
TITLE	Crop Farm Employee. Agricultural Cooperative Training. Vocational Agriculture. Revised.
INSTITUTION	Texas A and M Univ., College Station. Vocational Instructional Services.
PUB DATE	Jul 78
NOTE	714p.
AVAILABLE FROM	Vocational Instructional Services, Texas A and M University, F. E. Box 182, College Station, TX 77843 ($15.70).
PUB TYPE	Guides - Classroom Use - Materials (For Learner) (051) -- Tests/Evaluation Instruments (160)
EDRS PRICE	MF04 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Agricultural Education; *Agricultural Laborers; Agricultural Machinery; *Agricultural Production; Agriculture; *Agronomy; Autoinstructional Aids; Behavioral Objectives; Cooperative Education; Farm Accounts; Farm Labor; Farm Occupations; Fertilizers; *Field Crops; Grains (Food); Harvesting; Instructional Materials; Learning Activities; Pests; Plant Pathology; Secondary Education; Tests; *Vocational Education

ABSTRACT

Designed for students enrolled in the Vocational Agricultural Cooperative Part-Time Training Program, this course of study contains 13 units for crop farm employees. Units include (examples of unit topics in parentheses): introduction (opportunities in farming, farming as a science, and farming in the United States), farm records (keeping farm records, and using records in farm management), farm machinery--maintenance and operation (proper use of machinery and equipment, and maintenance of power machinery and equipment), farm structures and equipment (maintenance of farm structures and equipment, and building and maintaining farm fences), crop selection (important factors affecting the choice of crops), land preparation (importance of a good seedbed, row crop seedbed preparation, and land management practices), fertilizers (plant nutrients and their functions, types of fertilizers, and applying fertilizers), irrigation (importance of irrigation, sources of water and principal methods of irrigation, and irrigation management), weed control (importance of weed control, classification and identification of weeds, and control by mechanical and chemical methods), insect and pest control (safety, definition and classification of an insect, management, and insecticides), diseases and control (definition and classification of diseases by pathogens, principles of plant disease control, and chemical control), harvesting equipment (cotton pickers and strippers; corn snappers and pickers; corn combines; and forage harvesting equipment), and major crops (cotton, corn, forage and hay crops, grain sorghum, peanuts, rice, and small grains). Introductory materials include a course outline and a list of supplementary references. Provided for each unit topic is: an assignment sheet that presents the objective, a list of references, and a list of questions and activities; and information sheets with diagrams and drawings. Other contents include answer sheets for the questions and activities, tests on each topic, and answer sheets for the topic tests. (YLB)

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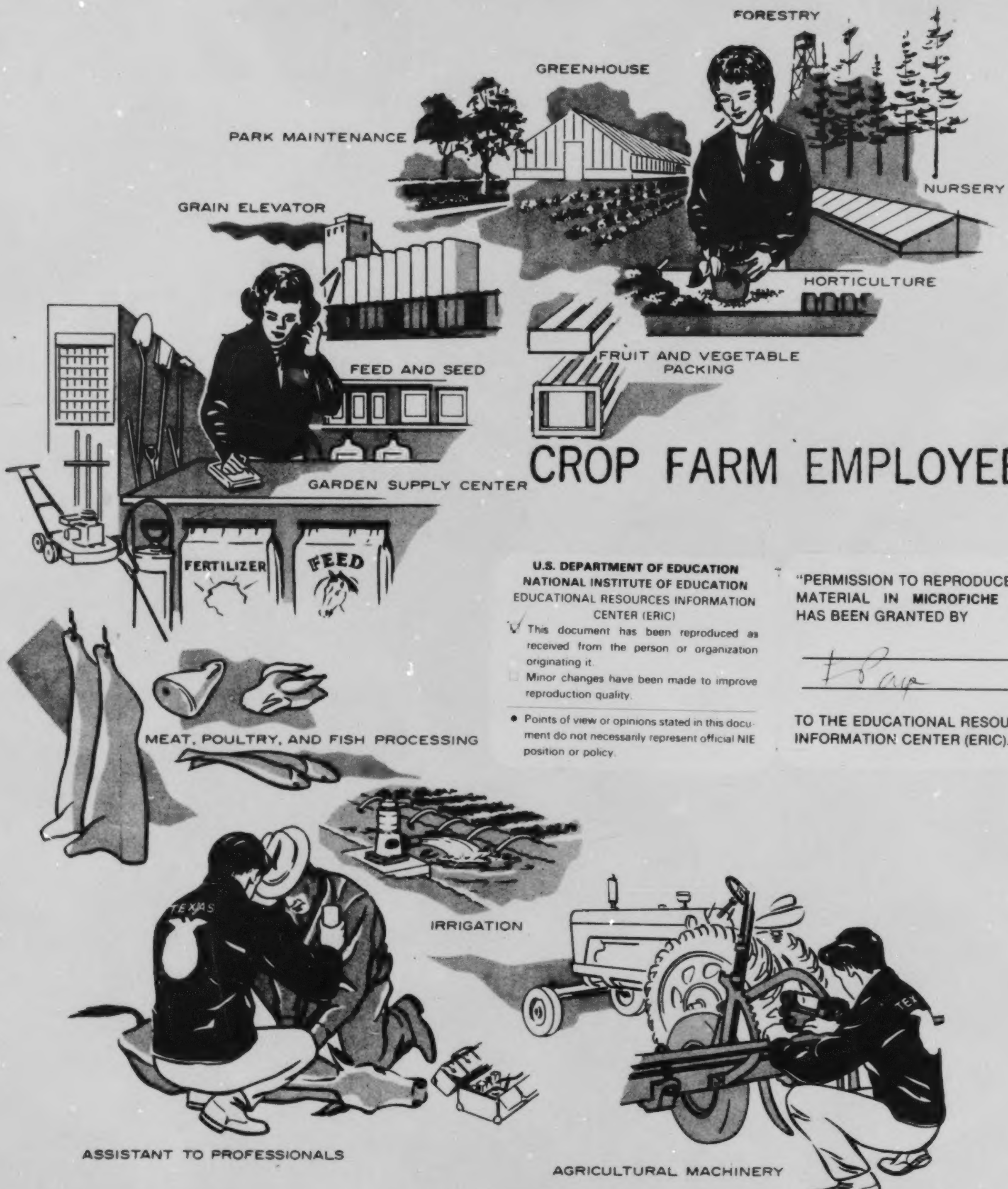
FORESTRY
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HORTICULTURE
FRUIT AND VEGETABLE PACKING
FEED AND SEED
GARDEN SUPPLY CENTER
FERTILIZER
FEED
MEAT, POULTRY, AND FISH PROCESSING
IRRIGATION
TEXAS
ASSISTANT TO PROFESSIONALS
AGRICULTURAL MACHINERY

CROP FARM EMPLOYEE

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ACKNOWLEDGMENT

State Advisory Committee for the Occupation
of
Crop Farm Employee

The Vocational Instructional Services Center Staff expresses its appreciation to the state advisory committee members for their contribution in planning this course of study. In the picture above, left to right, are G. Ray Sawyer, Hillsboro; Jake Caprielian, Crockett; Paul Bowers, Pampa; James M. Eller, Bryan; and Larry Robbins, Raymondville.

These materials, designed for the student enrolled in the Vocational Agriculture Cooperative Part-Time Training Program, were developed by Chester Boyd of Lewisville, Ernest Holman of Emory, and Milburn Wink of Hamlin. Because of their interest and dedication to the vocational agriculture program in Texas, they devoted three weeks at the Vocational Instructional Services Center in preparing these instructional materials.

Charles Palmer assisted in developing the materials by doing the art work. Gene Hix reviewed and edited the materials for the revised course of study. Revised references are used in this edition.

Acknowledgment is also given to Lester F. Buford, Subject Matter Specialist, who coordinated the development of these materials.

Foy Page, Coordinator
Vocational Instructional Services

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Vocational Instructional Services
Texas A&M University
College Station, Texas 77843

Revised: July, 1978

COURSE OUTLINE
FOR
CROP FARM EMPLOYEE

I. Introduction
   1. Opportunities in Farming
   2. History of Farming
   3. Farming as a Science
   4. Economics of a Farm Enterprise
   5. Farming in the United States
   6. Farming in Texas
   7. Farm Organizations and Farm Service Agencies

II. Farm Records
   1. Keeping Farm Records
   2. Using Records in Farm Management

III. Farm Machinery - Maintenance and Operation
   1. Proper Use of Machinery and Equipment
   2. Maintenance of Power Machinery
   3. Maintenance of Equipment

IV. Farm Structures and Equipment
   1. Maintenance of Farm Structures and Equipment
   2. Building and Maintaining Farm Fences

V. Crop Selection
   1. Important Factors Affecting the Choice of Crops

VI. Land Preparation
   1. Importance of a Good Seedbed
   2. Row Crop Seedbed Preparation
   3. Broadcast Crop Seedbed Preparation
   4. Permanent Pasture Preparation
   5. Land Management Practices (Leveling of Land, Drainage, and Erosion)

VII. Fertilizers
   1. Introduction
   2. Plant Nutrients and Their Functions
   3. Types of Fertilizers (Advantages and Disadvantages)
   4. Applying Fertilizers
   5. Soil Types and Fertilizer Use

VIII. Irrigation
   1. Importance of Irrigation
   2. Sources of Water and Principal Methods of Irrigation
   3. Irrigation Management

IX. Weed Control	1.	Importance of Weed Control
	2.	Classification and Identification of Weeds
	3.	Control by Mechanical Methods
	4.	Chemical Methods for Control
X. Insect and Pest Control	1.	Safety
	2.	Definition and Classification of an Insect
	3.	Management
	4.	Insecticides
XI. Diseases and Control	1&2.	Definition, Classification of Diseases by Pathogens
	3.	Principles of Plant Disease Control
	4.	Chemical Control
XII. Harvesting Equipment	1.	Cotton Pickers and Cotton Strippers
	2.	Corn Snappers, Corn Pickers, Corn Picker-Shellers, and Corn Combines
	3.	Forage Harvesting Equipment--Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Croppers, and Wafering Equipment
	4.	Combines
	5.	Small Grain Drills and Spin Broadcast Seeders
XIII. Major Crops	1.	Cotton
	2.	Corn
	3.	Forage and Hay Crops
	4.	Grain Sorghum
	5.	Peanuts
	6.	Rice
	7.	Small Grains
	8.	Cowpeas
	9.	Soybeans
	10.	Alfalfa and Clover

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for
CROP FARM EMPLOYEE

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Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Opportunities in Farming

OBJECTIVE: To acquaint the student with the many opportunities in farming.

REFERENCES:

Required:

1. Plant Science, Janick and others, pp. 21-24.
2. Information Sheet, "Opportunities in Farming".

QUESTIONS OR ACTIVITIES:

1. How important is agriculture in the world of work?
2. What are the major differences between early and present-day agriculture?
3. Is the farm population decreasing?
4. About how many people are employed in the agricultural industry?
5. Why is it possible for fewer farmers to feed more people?
6. Why is it necessary to know something about agriculture?
7. List the major occupational areas in agriculture.
8. What industry employs the largest number of people?
9. Is agriculture considered an average-size business?
10. How many people are there in the farming business?
11. Do the total farm assets exceed 200 billion dollars?
12. When was the USDA established (year)?
13. What was the name of the Act that established educational institutions in agriculture and the mechanical arts?

Information Sheet
on
OPPORTUNITIES IN FARMING

Agriculture is the largest industry in the United States. Not more than 25 years ago, agriculture was thought of only as tilling the land and producing crops and livestock. Modern agriculture includes farming, providing materials and services to the farmer, marketing, processing, and distributing the finished product. About 25 million people in the United States are employed in the agricultural industry. As the population continues to grow, there will be a greater demand for more people to enter the agricultural world of work.

The number of farms in the United States has continued to decrease each year, but the size of farms has become larger and more productive. One farmer can produce enough food and fiber for himself and more than 50 other people. Increased production through modern farming methods has caused the farmer to purchase more services and materials. Also, marketing, processing, grading, packaging, and distributing occupations have increased.

About one out of every three people employed in the world of work will use some knowledge of animal science, soil science, plant science, agricultural mechanics, and agricultural management or agricultural business. A knowledge of these occupational areas may include forestry, wildlife, conservation, recreation, horticulture, and turf management.

The major agricultural occupations are as follows:

1. Production occupations
    a. Crop farmer
    b. Dairy farmer
    c. Livestock farmer
    d. Part-time farmer
    e. General manager
    f. Farm manager
    g. Farm equipment operator
    h. Poultry farmer
2. Supply occupations
    a. Manager
    b. Serviceman
    c. Salesman
    d. Equipment operator
    e. Applicator

UNIT: Introduction
TOPIC: Opportunities in Farming
(Information Sheet continued)

3. Agricultural processing
    a. Meat processing manager
    b. Meat and poultry products salesman
    c. Crop inspector (fruit and vegetables)
    d. Poultry processor
4. Agricultural mechanics occupations
    a. Machinery mechanic
    b. Machinery set-up man
    c. Machinery manager
    d. Machinery service manager
    e. Machinery salesman
    f. Machinery partsman
5. Forestry occupations
    a. Forester
    b. Forest ranger
    c. Forest supervisor
    d. Logging specialist
    e. Saw mill operator
    f. Seedling or tree grower
6. Ornamental horticulture occupations
    a. Nursery manager
    b. Florist
    c. Landscape specialist
    d. Greenhouse manager
    e. Garden center salesman
    f. Tree surgeon
7. Conservation and recreation occupations
    a. Soil conservationist
    b. Parks and recreation manager
    c. Game warden
    d. Wildlife conservationist
    e. Fish hatchery employee
8. Other agricultural professional occupations
    a. Vocational agriculture teacher
    b. Farm loan officer
    c. County agricultural extension agent
    d. Farm organization employee
    e. Experimentation and research worker

UNIT: Introduction
TOPIC: Opportunities in Farming
(Information Sheet continued)

The off-farm occupations in agriculture continue to increase at a rapid rate. There are more people employed in the agricultural industry than in any other single industry in America. Most of the non-professional off-farm occupations require less than a college education, but the professional agricultural occupations require a college degree. Some of these areas are: animal science, agricultural engineering, agronomy, horticulture, forestry, entomology, plant pathology, bacteriology, agricultural chemistry, agricultural economics, rural sociology, parks and recreation, and veterinary science.

It is estimated that two to three jobs are available for each graduate of a college of agriculture. The land-grant colleges graduate about 7,000 students annually in their colleges of agriculture. Naturally, a graduate from a college of agriculture should have a background in the areas of research, business, industry, state and federal agencies, communication, production, and many other occupations, and therefore have a better opportunity for success than the non-professional individual with agricultural interests.

Farming is big business. The successful farmer must be a good businessman. He must have the technical knowledge and skill to increase his ability in applying new ideas that will reduce cost and increase his income. The farmer must remember there are 6,000,000 people in the farming business, and most of these farm people are farming because they are interested in farming as a career, and because of the net return of the occupation.

Approximately 216 million Americans depend on the farmer to furnish adequate food and fiber for their use. Many foreign countries also depend on the American farmer to supply a portion of their food and fiber needs. In order for the farmer to meet the many production demands, he must purchase more than 25 billion dollars worth of production items - supplies needed to produce food and fiber.

There are about 3 million farms in the United States with assets totaling approximately 240 billion dollars. The number of farms is continuing to reduce but at a lesser rate than a decade ago; however, the size of farms is increasing.

Modern agriculture does not lend itself to the same level of opportunity for a young man as was found a quarter a century ago. Most of the young agriculturalists do not climb the agriculture ladder—hired hand, tenant, and land owner. The larger farms are inherited by the children of farmers.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: History of Farming

OBJECTIVE: To become familiar with the history of crop production.

REFERENCES:

Required:

1. Plant Science, Janick and others, pp. 4-16.
2. Information Sheet, "History of Crop Production".

QUESTIONS OR ACTIVITIES:

1. Why is it necessary that the technical skills of the farmer change from day to day?
2. What has caused a need for advancement or improvement in agriculture?
3. How can the farmer meet the needs that are required to improve production?
4. What were the first crops of importance in the world?
5. What percent of the earth's surface is adaptable to cultivation?
6. List the countries that contributed to the major United States crops.
7. Where was the white (Irish) potato first discovered?
8. Is it true that all the major crops found in the United States today were imported as seed, seedlings, tubers, stocks, and other plant reproductive forms?
9. Name three crops that were used as cereals over 2,000 years ago.
10. Where and when was the plow invented?
11. Who were the people in the Near East who made remarkable contributions to technical agriculture?
12. In what part of the world was maize (corn) first cultivated?

Information Sheet
on
HISTORY OF CROP PRODUCTION

Crop husbandry began about 10,000 years ago when the first seed were planted and the first animals domesticated. Before plants and animals were domesticated there was little control over a continuous and adequate supply of food and clothing. People existed as nomadic hunters who gathered food and fiber by searching for it as they wandered over the earth.

About 10,000 years ago, hand-labor cultivation began in the Middle East. The early agriculturist had to draw upon wild plants and animals in order to develop major food plants and major animal breeds that are prevalent today. Agriculture spread from the Middle East to the western and northern shores of the Black Sea, then to the Valley of the Indies in eastern India and to northern China. The growth and development of early agriculture in the Western Hemisphere has been considered independent of agriculture and development in the eastern part of the world.

First Crops of Importance

Two varieties of wheat and barley were discovered in Iraq that indicated they had been grown 7,000 years ago. Both wheat and barley were developed in southwestern Asia. Wheat was first grown in Massachusetts in 1602.

Fossilized corn pollen said to be 60,000 years old has been discovered below Mexico City. Small corn cobs thought to be 6,000 years old were found in a cave in New Mexico. Corn and potatoes were among the major cultivated plants discovered in the New World.

All major crops used by man today were discovered in many parts of the world. It is assumed that field beans were first found and cultivated in the United States.

Rice was used extensively as a cereal in China by 2800 B.C. There are several wild species of it in southeast Asia; it is thought to have been developed in Asia. Rice was successfully grown in the New World for the first time in 1685, in the Carolinas.

Cotton, the king of fibers, was developed before the first century. In 1929, cotton fibers that dated back to 3000 B.C. were found in Pakistan. Cotton was grown in India about 5,000 years ago. When Columbus discovered the New World (1492) he found both cotton and tobacco being used by the natives.

UNIT: Introduction
TOPIC: History of Farming
(Information Sheet continued)

Sorghums originated as a cultivated plant in Africa thousands of years ago. Grain sorghum was developed in Africa, China, and India as a human food. It was developed in the United States mainly as a feed for livestock and poultry.

Crop production was considered a highly developed art at the time it appeared in Egyptian, Greek, and Roman writings.

The people from the Old World (Europe) brought many of their agricultural practices and skills to the New World (North America). Even though many of the crops were different from those found in Europe, similar farming practices were used to grow corn, tobacco, rice, and cotton.

Approximately 90 percent of the colonists were engaged in farming as late as 1800. Tobacco, rice, and cotton were the major export crops produced by the colonies. The invention of the cotton gin in 1793, and the invention of the mechanical reaper in 1831, increased the possibilities of exporting cotton and producing more grain crops at home.

Agricultural societies began to appear in the late 1700's on the European continent; departments (chairs) of agriculture in the universities were first established in the United States in the mid-1800's. Until 1862, the Department of Agriculture was a division of the Patent Office. In the same year, (1862) the Morrill Act granted governmental land to states for the purpose of establishing agricultural and mechanical colleges. Also, President Lincoln signed a bill that same year permitting farms to be established on governmental land (Homestead Act).

Crop Land Area

Only 7.7 percent of the earth's surface is adaptable to cultivation.

All the food and fiber crops in the United States (50 states) are produced on about 1,837,000,000 acres of land. The total land area in the fifty states is 2,271,000,000 acres.

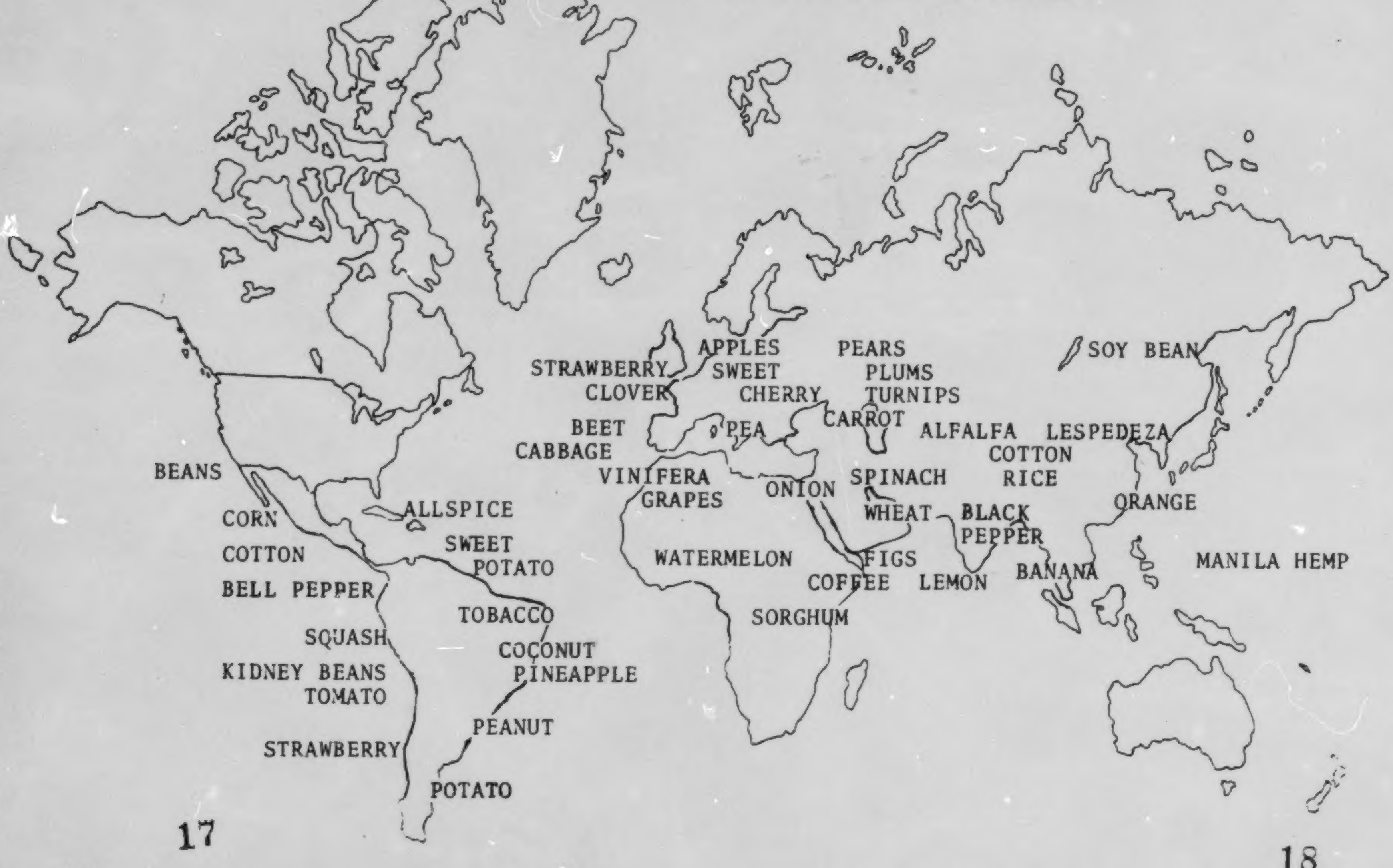
United States land usage for agriculture is as follows:
- Crop land - 458,000,000 acres
- Pasture - 633,000,000 acres
- Forest - 746,000,000 acres

UNIT: Introduction
TOPIC: History of Farming
(Information Sheet continued)

Texas upland area consists of 170,315,000 acres. The total area of harvested crops in 1966 was 18,330,000 acres.

Seventy percent of the world land cultivated area - 1.6 billion acres - is used to grow grain crops.

SOME WORLD CONTRIBUTIONS TO THE CROP PRODUCTION OF THE UNITED STATES


BEANS
CORN
COTTON
BELL PEPPER
SQUASH
KIDNEY BEANS
TOMATO
STRAWBERRY
POTATO
ALLSPICE
SWEET POTATO
TOBACCO
COCONUT
PINEAPPLE
PEANUT
STRAWBERRY
CLOVER
BEET
CABBAGE
VINIFERA GRAPES
APPLES
SWEET CHERRY
PEA
PEARS
PLUMS
TURNIPS
CARROT
ONION
SPINACH
WHEAT
WATERMELON
FIGS
COFFEE
SORGHUM
ALFALFA
COTTON
RICE
BLACK PEPPER
LEMON
BANANA
SOY BEAN
LESPEDEZA
ORANGE
MANILA HEMP

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Farming as a Science

OBJECTIVE: To understand the importance of technology, research, and experimentation techniques in the farming industry.

REFERENCES:

Required:

1. Plant Science, Janick and others, pp. 22-24.
2. Information Sheet, "Farming as a Science".

QUESTIONS OR ACTIVITIES:

1. Why can the farmer of today produce more food and fiber than he produced in 1910?
2. What forms of agricultural chemicals have aided the farmer to increase crop yields?
3. What changes have affected cotton production since the invention of Whitney's gin?
4. Why is it important that technical changes continue to take place in crop production?
5. List three major ways that agricultural research helps the farmer.
6. Give the approximate number of farm workers in the nation.
7. What is the nation's largest industry?
8. When did the replacement of animal power take place in agriculture?
9. What crops have been greatly increased in the developing world since 1960?

Information Sheet
on
FARMING AS A SCIENCE

Webster defines agriculture as "the science or art of cultivating the soil, producing crops, and raising livestock". Although this definition still applies, it could be expanded. Today, agriculture is more than just farming, but farming itself is still important since it employs 6,000,000 workers--more than all people employed in transportation, public utilities, the steel industry, and the automobile industry.

American agriculture has advanced more in the past 50 years than in all the prior years of our history. Because of progressive systems of marketing, processing, and merchandising, modern farming and ranching provide plenty of good, wholesome food and other products for the home and industry.

Agriculture is a skilled scientific profession. It involves the biological, physical, and social sciences. Twenty percent of all scientists or about 80,000 scientists are working in life sciences and agriculture.

Modern agriculture supplies over 10,000,000 workers with raw materials to transport, process, market, and manufacture in the United States. The American farmer supplies four times as much raw materials per worker as in 1920. Businesses such as feed, seed, fertilizer, chemicals, machinery, buildings, oil products, electricity, and tools are suppliers in the field of agriculture. Approximately 6,000,000 workers are employed in these supply fields.

The population of the United States are the best fed people in the world. The American is recognized as the leader in food power. All kinds of food can be purchased out of season. For example, it is not necessary to wait until harvest to purchase apples; they can be purchased any time during the year. Food is plentiful, wholesome, and safe. The teamwork of scientists, farmers, educators, processors, manufacturers, distributors, and retailers share the responsibility in developing the nation's largest industry.

Research by industry and government is constantly finding new ways to increase production, improve the soil, control insects and diseases, and improve agriculture in general. Agricultural research is involved in lawn management, ornamental landscaping, development of recreational areas, and anti-pollution programs. Agricultural scientists have also cooperated with medical scientists in agricultural products studies on trace elements, vitamins, and certain drugs. Four agricultural scientists have received Nobel Prizes in medicine for research achievements. Agricultural research helps the

UNIT: Introduction
TOPIC: Farming as a Science
(Information Sheet continued)

farmer in the following ways:

1. It provides new markets for agricultural products.
2. It improves the possibility of producing a better quality and a larger quantity of crop yields.
3. It reduces the amount of labor required to produce a crop.
4. It provides the necessary knowledge to use improved practices.
5. It provides the knowledge and skill used to produce more food on less land.
6. It provides information for a better education in agronomy, engineering, biology, nutrition, economics, chemistry, pathology, genetics, and entomology.

Research is conducted by commercial companies and corporations, agricultural experimentation, individuals receiving grants (money and/or facilities), and foundations.

Scientific agriculture has released all but 6,000,000 of the nation's 72,000,000 workers to non-farming occupations. Agriculture is one of the nation's largest industries.

The first major change in agricultural technology was in the twentieth century. Horse power had been used until about 1925 for general farming purposes. The animal or horse power was replaced with tractor power in the 1920's.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Economics of a Farm Enterprise

OBJECTIVE: To determine the feasibility of starting new enterprises or discontinuing enterprises that fail to produce a profit.

REFERENCES:

Required:

1. Plant Science, Janick and others, pp. 700-708.
2. Information Sheet, "Economics of a Farm Enterprise"

QUESTIONS OR ACTIVITIES:

1. When should an enterprise be discontinued?
2. When should an enterprise be added?
3. What governmental factors affect the farm enterprise?
4. What is the most important factor that affects the type of farm enterprise?
5. Explain why a balanced farm program is important.
6. List six economic factors that influence farming.
7. How do some farmers get started in farming?
8. What is meant by the term economic growth?

Information Sheet
on
ECONOMICS OF A FARM ENTERPRISE

Many farms have enterprises that either fail to make a net return on the investment or they lose money. There are many factors that influence the type of farming that is found in any given area. For example, the type and price of land, the demand for the raw product, the distance to a suitable market, the cost of producing the crop, the price received for the crop, transportation facilities, available labor, and the climatic conditions in the area. Other factors such as seed cost, harvesting machinery, and storage facilities must be considered before selecting a special enterprise.

If the estimated costs exceed the income for an enterprise in a farming operation, the farmer should consider that the enterprise is not feasible, and then select another enterprise that will pay a dividend. A crop enterprise should be discontinued if the following conditions exist:

1. The crop is not well adapted to the climatic conditions.
2. The crop is not resistant to the local diseases, for example, cotton rootrot.
3. Insect control problems cannot be eliminated or the cost of controlling is too expensive.
4. There is a lack of an adequate market for the crop.
5. Proper machinery cannot be purchased to produce the crop.
6. The crop fails to produce a net income large enough to justify it as a farm enterprise.

A new enterprise should be added on a small scale, after it has been carefully studied. The following conditions should prevail before adding a new crop on a large scale:

1. An adequate market should be available for the crop.
2. The crop should be adaptable to the locality.
3. If possible, the crop should be resistant to certain insects and diseases that may reduce its production.
4. The new crop should produce an adequate net return.
5. The producer should be interested in producing it as one of the farm enterprises.

There must be a demand for any kind of farm enterprise. If the supply exceeds the demand the enterprise may result in a loss instead of a gain. Many farmers tend to either increase production or add a new enterprise when the price of that particular enterprise increases. In most cases enterprises are added to a farm operation

5

UNIT: Introduction
TOPIC: Economics of a Farm Enterprise
(Information Sheet continued)

when there is a possibility of receiving an adequate net return for the product. Prices change due to the following reasons:

1. Crop yields change from year to year.
2. The amount of arable and irrigated land changes from year to year.
3. There is a variation in the consumer demands. The demands are usually regulated by the consumer income.
4. Wars affect the prices of farm crops.
5. Export markets influence price changes. For example, millions of tons of small grains are sold abroad each year.
6. The production season also causes price changes. Early crops may bring better prices than the late crops.

Most modern day farms are considered nondiversified. The farmer may consider that he has a balanced program with one or two crops, even though he is really employed one-half the year. A wheat farmer may be employed only about four months in the year. A balance of farm enterprises is determined by the climate, type of soil, growing season, market, interest of the producer, and the financial circumstances.

Farming is considered one of the largest and most important businesses in the United States. Yet, farming must depend upon other types of businesses in order to produce and market crops. Several years ago an individual could get started in farming by becoming a tenant on small acreage. Many farmers continued to get started in farming by renting land, although the initial investment to get started in a family size farm may exceed $50,000. This cost does not include the value of the land. Most of the modern day farmers do not climb the ownership ladder, that is, enter farming as a hired hand, a tenant, and owner. If a farmer is to be a successful owner, he must be a scientist, businessman, laborer, mechanic, and know how to get along with others.

The governmental factors that have affected the farm enterprises are:

1. The farmer is furnished technical assistance through Agricultural Experiment Station Specialists, County Agricultural Agents, other governmental agencies, and commercial specialists. Assistance is given to improve the soil, produce better quality crops, control insects and diseases, and make government payments (subsidy) to control prices during and after a war.

UNIT: Introduction
TOPIC: Economics of a Farm Enterprise
(Information Sheet continued)

2. The government provides loans to farmers at low interest rates.
3. Foreign countries are granted and lent money to purchase agricultural products from the United States.

Not until the mid 1900's did farming operations become complicated. The self-sufficient farming economy provided the farm family most of the necessities. A small cash reserve was needed to buy medicine, clothes, food seasoning, and some farm machinery. The farm food supply was largely grown at home. If the farmer sold cream, butter, eggs, grain, cotton, wool, and other products, the amount placed on the market regulated the prices.

During the early 1900's most farms had a balanced or diversified farming program; that is, the farmer was involved with more than one enterprise. Labor and income were more evenly distributed throughout the year.

Six major economic factors affect the type of farming program in any state. They are:

1. Crop yields
2. Amount of arable land
3. Consumer demands
4. Wars
5. Export markets
6. Early markets

Most farmers start farming simply because they want to farm. They usually begin with very little capital. Therefore, they need to use good management practices, coupled with hard work, in order to become successful farmers.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Farming in the United States

OBJECTIVE: To develop an understanding of crops planted, land use, areas of production, and production potential in the United States.

REFERENCES:

Required:

1. Information Sheet, "Farming in the United States."

QUESTIONS OR ACTIVITIES:

1. Where did the main crops grown in the United States originate?
2. How much of the land area in the United States is devoted to crop production and other uses?
3. Where are the major crop producing areas in the United States?
4. What is the total value of the principal crops grown in the United States?
5. What will crop production need to do to meet the demand for food and fiber in the future?
6. Are the number of areas available for farming increasing or decreasing and why?
7. What is the possibility of converting more land to crop use?

Information Sheet
on
FARMING IN THE UNITED STATES

The first cash crops grown in the United States were corn, tobacco, rice, and cotton. There were about 36,000 bales of cotton exported in 1800. The first colonists that arrived in North America were primarily agriculturists. In 1800, approximately 90 percent of the adults were considered farmers. Most of the farm work was accomplished by hand labor.

In 1831 the first reaper was developed by Cyrus McCormick. Twenty years later the twine binder was developed, thus making hand labor available for other types of farm chores. These harvest methods increased the acreage planted in grain crops.

The United States Census Bureau predicts that there will continue to be a steady rise in the number of people living in the United States. With this steady increase in population there will be an increased demand for more crop production to meet the food requirements of this expanded population.

To produce the additional crops needed, the crop producer will need to learn and use new technological information to increase his productivity.

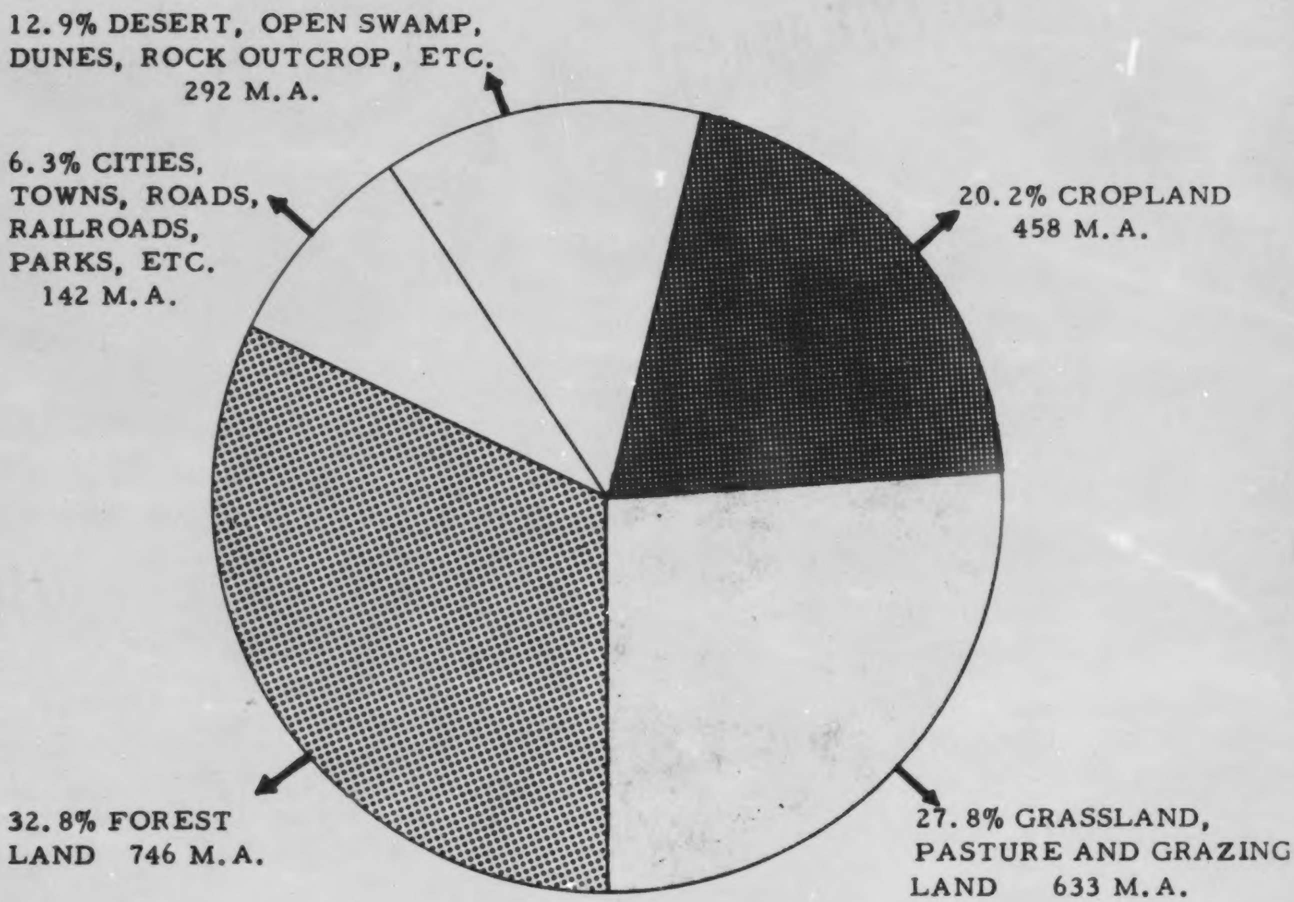
Each year, thousands of acres of land are being diverted from crop production due to erosion, poor fertility levels, highway right-of-way, housing developments, water reservoirs, and other non-agricultural uses. The United States Department of Agriculture officials predict that this will continue for many years to come. Most of the crop-lands are found in the eastern half of the United States. About 20 percent of the land area in the United States is devoted to cropland and about 60 percent is in forest and grassland.

There are thirteen major agricultural regions in the United States. All thirteen regions produce some type of crop, hay, or forest products.

MAJOR USES OF LAND

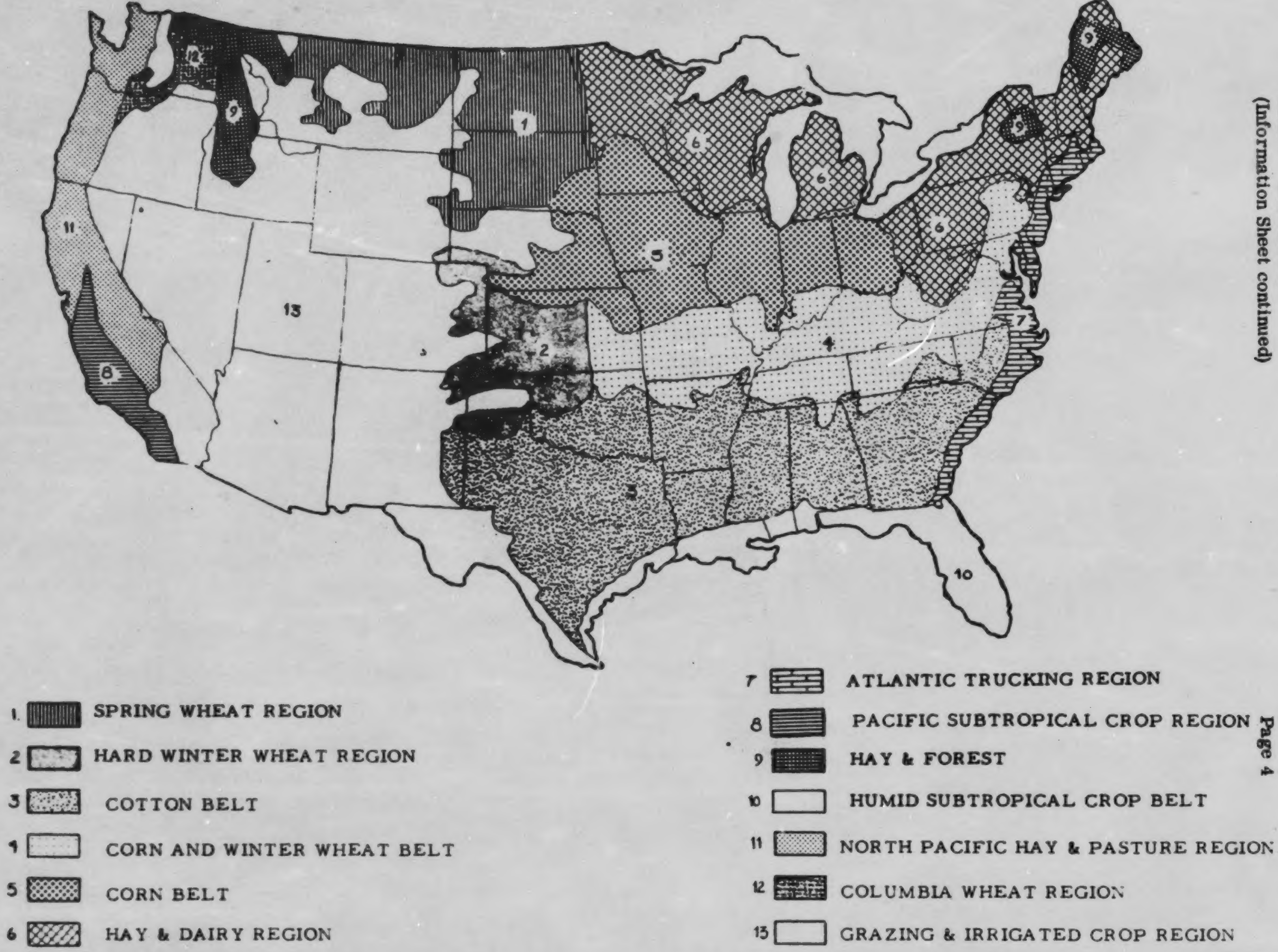
TOTAL U.S. ACREAGE

2,271 MILLION ACRES (50 STATES)



M.A. - MILLION ACRES

MAJOR AGRICULTURAL REGIONS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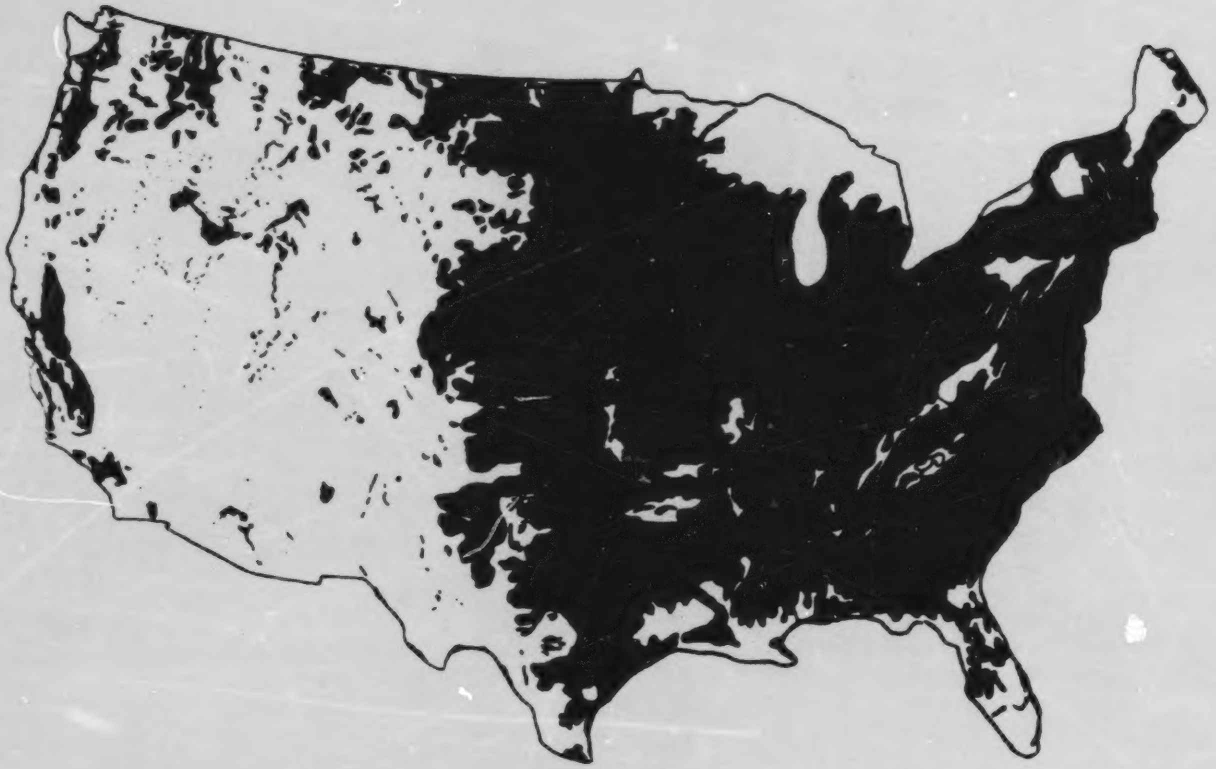
1. SPRING WHEAT REGION
2 HARD WINTER WHEAT REGION
3 COTTON BELT
4 CORN AND WINTER WHEAT BELT
5 CORN BELT
6 HAY & DAIRY REGION
7 ATLANTIC TRUCKING REGION
8 PACIFIC SUBTROPICAL CROP REGION
9 HAY & FOREST
10 HUMID SUBTROPICAL CROP BELT
11 NORTH PACIFIC HAY & PASTURE REGION
12 COLUMBIA WHEAT REGION
13 GRAZING & IRRIGATED CROP REGION

DESERTS, MOUNTAINS AND INFERTILE SOILS LIMIT CROP AREAS IN THE U.S.



■ LAND AREAS WITH CROPLAND

☐ LAND AREAS WITHOUT CROPLAND

MAJOR CROPS PRODUCED IN THE U.S.
Statistical Information - 1975
Table 2

CROP	MILLION	1,000 ACRES
COTTON	11 bales	9,554
GRAIN SORGHUM	758 bushels	12,837
WHEAT	2,133 bushels	49,843
RICE	5.1 tons	1,967
CORN	5,766 bushels	56,888
BARLEY	382 bushels	10,227
RYE	17 bushels	1,283
PEANUTS	3,866 pounds	1,436
COTTONSEED	3 tons	9,554*
FLAXSEED	14 bushels	2,627
SOYBEANS	1,521 bushels	36,644
DRY BEANS	17 cwt.	1,519
TOBACCO	2,184 pounds	976
SUGAR BEETS	29 tons	1,161
SUGARCANE	28 tons	630
HAYS	132 short tons	65,192
OATS	656 bushels	17,848
IRISH POTATOES	315 cwt.	1,479
VEGETABLES	(1,629) dollars	(0)**
CITRUS FRUITS	304 boxes	(0)**
PECANS	115 pounds	(0)**

*same as cotton for lint
**not applicable

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Farming in Texas

OBJECTIVE: To become familiar with farming in Texas.

REFERENCES:
Required:
1. Information Sheet, "Farming in Texas".

QUESTIONS OR ACTIVITIES:

1. What were the cash receipts for crops and livestock in Texas in 1975?
2. What was the value of farm assets in 1975?
3. What was the value of services and supplies farmers secured from suppliers?
4. What are some sources of information about farming in Texas?
5. How many major crop producing and market reporting areas or districts are there in Texas?
6. How many farms were there in Texas in 1975 and what was the average size of a farm?
7. What is the latest trend in Texas agriculture and some reasons for the trend?

Information Sheet
on
FARMING IN TEXAS

Texas has a larger production capacity for crops and livestock. The latest annual agricultural reports show that Texas farmers and ranchers produced an income from crops and livestock in the amount of $5,819,579,000. Crop receipts amounted to $2,848,000,000.

During this reporting year farm and ranch assets totaled $49,500,000,000. This included machinery and real estate.

In order for Texas farmers to produce these crops and livestock they spend over $2,000,000,000 for goods, services, and supplies from farm suppliers.

If a person is to become well informed about farming in Texas he should read reports put out by the Texas Department of Agriculture, farm organizations reports, United States Department of Agriculture reports, radio and TV programs, Extension Service Annual reports, and refer to the latest Texas Almanac.

The 1975 reports gave reasonably accurate information of the number, size, and kinds of farms in the state.

Texas agriculture has a bright future and the reasons for it are many, but a few of the major ones could be listed as:

1. A varied climate that allows a broad range of agricultural products to be grown
2. Many public and private agencies working to make agriculture a better way of life
3. The general level of economy in the United States

One of the biggest reasons for a bright future in Texas agriculture is the Texas Department of Agriculture. Texas is about the only state that has an active Department of Agriculture, and the only state whose Department of Agriculture is attempting to expand the market for Texas products around the world, and here at home. In this way, finding new outlets for Texas crops, the Department of Agriculture is probably one reason that Texas farmers are finding it easier to sell their products at higher prices than ever before. This is because tax dollars from Texas are being diverted into the Department for the sole purpose of creating a demand for Texas agricultural products, and this is the name of one phase of the program usually referred to as TAP.

UNIT: Introduction
TOPIC: Farming in Texas
(Information Sheet continued)

Texas is divided into fifteen crop reporting regions. Information and statistics of field crops are reported annually to the Statistical Reporting Services of the Texas Department of Agriculture and the United States Department of Agriculture. For example, the acres planted for all purposes, acres harvested of various crops, yield per acre, and total yield in unit measure are reported annually by the county in each of the districts.

The major crops grown in each of the districts are as follows:

Northern High Plains. Sorghum, wheat, hay, soybeans, cotton, vegetables, and barley

Southern High Plains. Cotton, sorghum, hay, and vegetables

Northern Low Plains. Wheat, barley, oats, hay, alfalfa, and guar

Southern Low Plains. Cotton, sorghum, wheat, oats, and hay

Cross Timbers. Oats, peanuts, hay, and wheat

Blacklands. Cotton, sorghum, wheat, barley, oats, corn, peanuts, vetch, and hay

East Texas. Corn, oats, peanuts, hay, soybeans, vetch, vegetables, and fruit

Trans-Pecos. Cotton, sorghum, barley, and hay

Edwards Plateau. Sorthum, oats, peanuts, and hay

South Central. Corn, sorghum, rice, cotton, flax, vegetables, and hay

Coastal Bend. Cotton, sorghum, flax, and hay

Upper Coast. Rice, sorghum, cotton, corn, vegetables, and hay

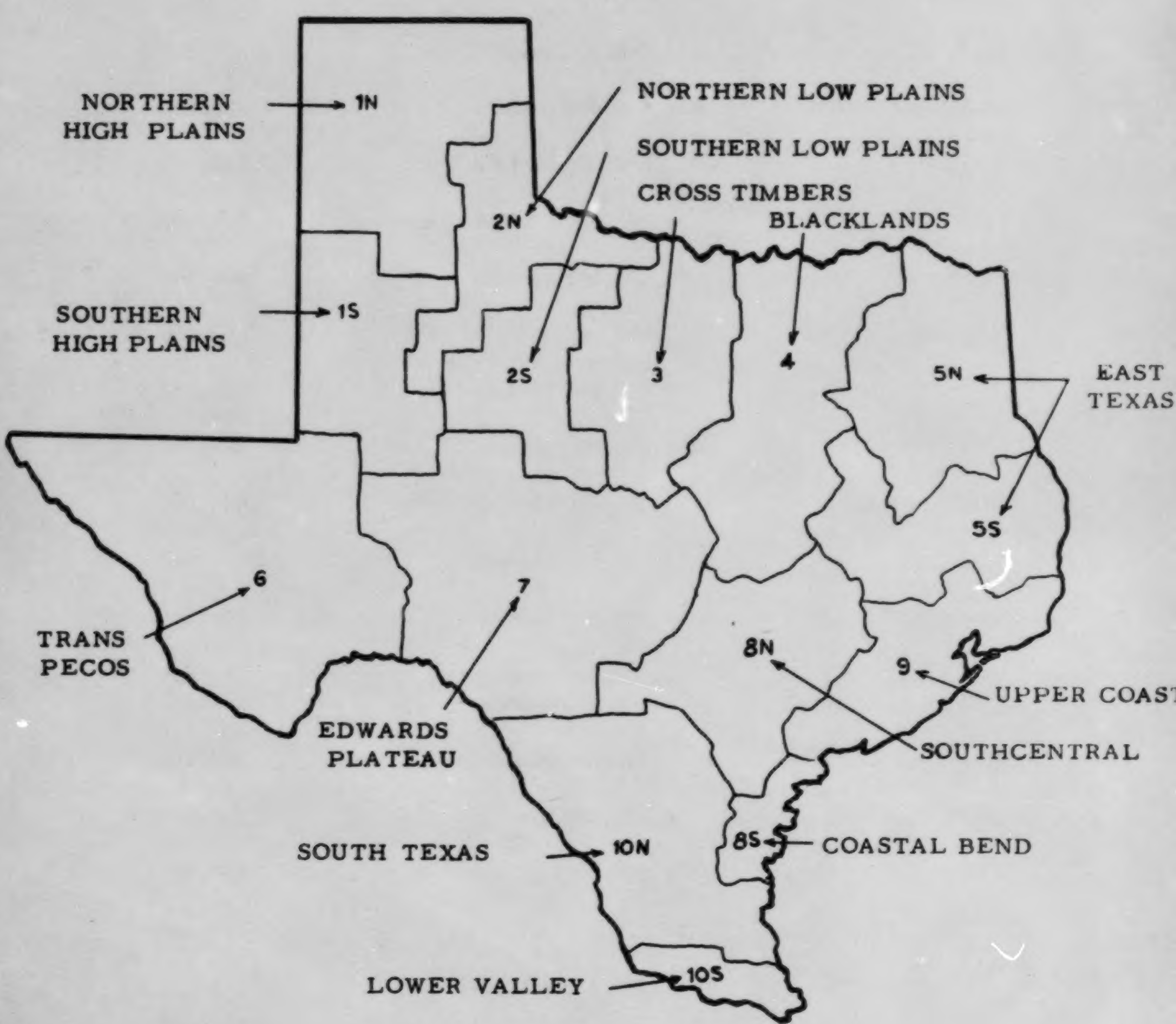
South Texas. Sorghum, peanuts, vegetables, flax, and citrus

Lower Valley. Cotton, sorghum, corn, hay, vegetables, and citrus

UNIT: Introduction
TOPIC: Farming in Texas
(Information Sheet continued)

Statistics on crop production from each district can be secured from the current Texas Almanac, Texas Extension Service, United States Department of Agriculture, and the Texas Department of Agriculture.

TEXAS CROP REPORTING DISTRICTS


NORTHERN HIGH PLAINS
1N
NORTHERN LOW PLAINS
SOUTHERN LOW PLAINS
CROSS TIMBERS
BLACKLANDS
2N
SOUTHERN HIGH PLAINS
1S
2S
3
4
5N
EAST TEXAS
5S
6
7
TRANS PECOS
8N
9
UPPER COAST
EDWARDS PLATEAU
SOUTHCENTRAL
SOUTH TEXAS
10N
8S
COASTAL BEND
LOWER VALLEY
10S

MAJOR CROPS IN TEXAS
(These statistics vary each year)
Approximate Amounts

CROP	QUANTITY	ACRES
COTTON	2,646,000 bales	3,625,000
GRAIN SORGHUM	312,000,000 bushels	6,735,000
WHEAT	52,800,000 bushels	3,326,000
RICE	25,258,000 - 100 lb. bags	508,000
CORN	73,600,000 bushels	800,000
BARLEY	1,350,000 bushels	50,000
RYE	200,000 bushels	25,000
PEANUTS	420,375,000 pounds	295,000
COTTONSEED	1,019,000 tons	3,625,000
FLAXSEED	374,000 bushels	34,000
SOYBEANS	7,830,000 bushels	261,000
COWPEAS (Dry)	6,250,000 pounds	12,500
COWPEAS (Green)	3,000,000 pounds	3,000
SUGAR BEETS	370,000 tons	19,700
HAYS	5,100,000 tons	2,297,000
VEGETABLES (All)	(178,272,000) dollars	196,450
CITRUS FRUIT (All)	(28,190,000) dollars	(5,125,000)*
OTHER FRUITS	764,475 bushels	(0)**
PECANS	38,000,000 pounds	(0)**

*Trees
**Not applicable

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Farm Organizations and Farm Service Agencies

OBJECTIVE: To acquaint the student with the various farm organizations and farm service agencies.

REFERENCES:
Required:
1. Information Sheet, "Farm Organizations and Service Agencies".

QUESTIONS OR ACTIVITIES:

1. What are the three major organizations that were organized by the farmers?
2. What is the approximate number of members in each organization?
3. What are the main purposes of cooperative organizations?
4. What is the purpose of the National Farmers Organization?
5. What is an example of a large cooperative that serves many farmers?
6. Why do farmers become members of organizations?
7. When did the United States Department of Agriculture become a service agency for the farmer?
8. What are some of the functions of the U.S.D.A.?
9. How many major agencies are in the U.S.D.A.?
10. What three groups of rural people are served by vocational agricultural education?

Information Sheet
on
FARM ORGANIZATIONS AND SERVICE AGENCIES

There are three major organizations that were started by the farmers themselves. The three organizations basically emphasize the improvements of the farm community life.

The American Farm Bureau Federation is the largest of the three major organizations. It was founded as a national organization in 1921 and is the largest organization with over one and one-half million members. The Farm Bureau has been instrumental in getting laws passed on a state and national level that aid the farmer in getting better farm prices, farm credit, better roads, schools, health programs, and soil conservation programs. It has also been a leader in establishing cooperatives to aid the farmer when he is buying and selling. Many activities have been organized through the efforts of the Farm Bureau for the sons and daughters of its members.

The National Grange of the Order of Patrons of Husbandry was founded in 1867; therefore, it is the oldest of the three major farm organizations. It is the second largest organization with over 850,000 members. One of the main objectives of the "Grange" is to develop a better community life by improving family life. Cooperation and leadership are strong points with the "Grange". It takes an active part in working with the three institutions found in the rural community, the home, school, and church. The "Grange" also takes an active part in legislation that affects the farmer.

The Farmer's Union was organized in 1902, in order to help the farmer in the following ways: legislation, education, and cooperation. Its 200,000 members also support farm youth organizations and activities. The Farmer's Union is based on one membership per family. The "Grange" may also include several members of a family as one membership.

There are several kinds of cooperative organizations that are used by farmers to process, store, and market their produce and to purchase supplies and services. A cooperative is an organization of agricultural producers chartered to transact collectively business pertaining to agricultural products, supplies, or services. The Texas Cooperative Marketing Act gives such associations legal status and defines their purposes and powers. According to the Act a cooperative marketing or purchasing association may be formed by five or more persons engaged in the production of agricultural products.

The National Farmers Organization (NFO) is an organization that was established to market farm produce for its members. This cooperative organization was

UNIT: Introduction
TOPIC: Farm Organizations and Service Agencies
(Information Sheet continued)

organized by farmers and for farmers; therefore, membership is limited to farmers.

In 1926, Congress passed a law that enacted the Cooperative Marketing Act. This Act permits the United States Department of Agriculture to give assistance to farmers who are interested in cooperatives.

The Rural Electric Administration (REA) permits farmers to form cooperatives either to purchase electric power or borrow funds to construct power facilities.

There are various local organizations that are of service to the farmer and rural community. Many of these organizations take on a local name, for example: "County Cattle Breeders Association", "The Community Social Club", and "Community Worker Organization".

Farmers become members of organizations for the purpose of receiving benefits or help that they could not obtain as an individual. Usually, group efforts are much more effective than individual efforts if the farmer is seeking better prices for his products or if he is making purchases to lower his cost of production.

The United States Department of Agriculture became a service agency by an Act of Congress in 1862. The Department of Agriculture is directed by law to acquire and diffuse useful information on agricultural subjects in the most general and comprehensive sense. The Department performs functions relating to research, education, conservation, marketing, regulatory work, agricultural adjustment, surplus disposal, and rural development. It conducts research in agricultural and industrial chemistry, the industrial uses of farm products, entomology, soils, agricultural engineering, agricultural economics, marketing, crop and livestock production, production and manufacture of dairy products, human nutrition, home economics, forestry, and conservation. Results of research are made available for practical farm application through extension and experiment station work in cooperation with the States.

The Department provides crop reports, commodity standards, Federal meat and poultry inspection service, other inspection, grading, and marketing services. It seeks to eradicate and control plant and animal diseases and pests and administers many regulatory laws designed to protect the farmer and the consumer.

UNIT: Introduction
TOPIC: Farm Organizations and Service Agencies
(Information Sheet continued)

The agencies within the Department are as follows:

1. Agricultural Marketing Service - The Agricultural Marketing Service is organized to aid in advancing the orderly and efficient marketing and distribution of products grown on the nation's farms. It is divided into two broad organizational groups: one covering Marketing Services and the other covering Marketing Research and Statistics. The Agricultural Estimates Division (Crop Reporting Service) is one of three divisions under the Marketing Research and Statistics group. The statistical work now carried on by the Agricultural Estimates Division is actually older than the Department of Agriculture.

   The purpose of the Crop Reporting Service is to collect and disseminate statistical information on acreage, yield, production, supplies of crops, production value, and utilization of livestock and livestock production: also such related data as prices received and paid by farmers, and farm employment and wage rates. This service is available to farmers from Austin.

2. Agricultural Research Service - The Agricultural Research Service of the United States Department of Agriculture was created November 2, 1953, as a result of a general reorganization of the Department's services. It conducts all the Department's research on production and utilization of farm products (except forestry research) and in human nutrition and home economics. The Service also conducts certain crop and livestock regulatory programs aimed at keeping farmers informed about pests and diseases.

   The Agricultural Research Service has a two fold responsibility: (1) To conduct research aimed at finding better methods of farming, improving the farm home, breeding better types of plants and animals, gathering new knowledge that will enable farmers to produce more efficiently, and finding new uses for agricultural products. (2) To put the results of research to work in regulatory programs that protect farms from invasion by foreign pests and diseases, to eradicate dangerous pests and diseases that invade us, and to reduce the damage from those for which eradication is impossible or impractical. This Service furnishes information to the farmer.

3. Agricultural Stabilization and Conservation Committees - The present Agricultural and Conservation Committees are Federal agencies responsible

UNIT: Introduction
TOPIC: Farm Organizations and Service Agencies
(Information Sheet continued)

for the development, administration, and operation of the following: Agricultural Conservation, Commodity Loan, Purchase Agreement, Acreage Allotment, Marketing Quota, Direct Purchase, Wool, Honey, and Soil Bank Programs.

County and community committees of farmers are elected by the farmers in a county. These committees, known as the Agricultural Stabilization and Conservation County and Community Committees, are used by the Commodity Stabilization Service and the Agricultural Conservation Program Service in the execution of all programs dealing directly with farmers. State committees are appointed by the Secretary of Agriculture under authority of the Soil Conservation and Domestic Allotment Act and are known as Agricultural Stabilization Conservation (ASC) State Committees. ASC State Committees, subject to the general direction and supervision of the Administrator of the Commodity Stabilization Service, are generally responsible for carrying out the Commodity Stabilization Service and Agricultural Conservation Program Service activities within the State.

Under the Agricultural Conservation and Soil Bank Programs, farmers are assisted in entering into partnership with the government to carry out approved conservation practices on their farms. The financial aid received from the government is from 50 percent to 80 percent of the cost of carrying out the practices.

These agencies help farmers to cooperate with the national effort to adjust agricultural production and marketing through the Acreage Allotment, Soil Bank, and Marketing Quota Programs. They assist them in obtaining price support by loans and purchase agreements on certain crops.

4. Commodity Credit Corporation - In 1948 the CCC became an agency of the United States Government under a permanent Federal charter.

   Commodity Credit Corporation stabilizes the prices farmers receive for certain "supported" commodities, including grain, rice, cotton, tobacco, wool, mohair, honey, milk, butterfat, cottonseed, flaxseed, soybeans, peanuts, dry edible beans, and gum naval stores. Support operations stabilize prices by providing farmers a cash return at the support level for supported commodities.

UNIT: Introduction
TOPIC: Farm Organizations and Service Agencies
(Information Sheet continued)

The loan method of support used for all supported commodities (except dairy products, wool, and mohair), gives the farmer an opportunity either to market his crop or keep it under loan. If the market prices rise above the loan level, he may deliver the commodity pledged as collateral instead of repaying the loan.

Purchase agreements provide a convenient and inexpensive form of "price insurance" for producers who do not have an immediate need for cash or who are not able to meet loan storage requirements. Incentive payments, used only for wool and mohair, are a direct form of price support; whereas purchases, used mainly for dairy products, are an indirect type of support.

Commodity Credit Corporation also makes loans to farmers to finance new farm storage facilities. Loans are made up to 80 percent of the cost of the structures.

Price support operations in the field involving direct dealings with farmers are a responsibility of County Agricultural Stabilization and Conservation (ASC) Committees.

5. Farmers Home Administration - The objective of the Farmers Home Administration is to enable farm families to become soundly established in successful, well-balanced systems of farming. The agency's purpose is to help farmers reach the point where they can proceed with good farming using credit furnished by private or cooperative lenders. The credit extended is intended to supplement private or cooperative credit. The agency makes loans only to farmers who cannot obtain the credit they need on reasonable terms from other lenders. Loans made are accompanied by technical assistance in the development of sound farming systems and the adoption of improved farm management practices. Borrowers are required to refinance their loans with other lenders at the earliest possible date.

   State directors are responsible for the administration of the program within states, and all Farmers Home Administration loans are made and serviced through a system of county offices, under the direction of a county supervisor. A county committee, composed of three members in each county, advises with the county supervisor and has definite responsibility of determining eligibility of applicants, reasonable value of farms, and recommendations regarding debt settlement.

UNIT: Introduction
TOPIC: Farm Organizations and Service Agencies
(Information Sheet continued)

6. Soil Conservation Service - The U.S. Soil Conservation Service is the technical soil and water conservation action agency of the U.S. Department of Agriculture. A highly trained staff of soil and water conservationists give on-the-land technical help to landowners and operators. Formed in 1935, the agency engaged in demonstrational work until 1940. Field office people with SCS help landowners and operators to cooperate with these districts and participants in the Agricultural Conservation Program by using soil and water conservation and watershed protection techniques.

7. Federal Crop Insurance Corporation - The Federal Crop Insurance Corporation, created within the Department of Agriculture in 1938, provides farmers an opportunity to insure money invested in growing crops against loss from causes beyond their control, such as adverse weather, insect infestation, and plant diseases. However, it is still in an experimental stage of development and is not yet available on all crops or in all counties. Where available, farmers are afforded a business way to provide, through insurance, their own emergency assistance against crop disasters which otherwise frequently result in requests for special Governmental assistance.

8. Federal Extension Service - Cooperative extension work is basically a program of education through which scientific and technical knowledge is applied to farm and home situations as a means of improving the economics and social welfare of rural people. County agricultural, home demonstration, and 4-H Club agents are located in nearly all the agricultural counties of the United States. These county extension agents make available to farmers, farm homemakers, and rural youth the results of research conducted by the Department of Agriculture, the land-grant institutions, and other research agencies adapted to local farm and home conditions. County extension agents take the lead in organizing their counties for county program making in which farm families, technicians, and administrative workers plan together to combine scientific information, local experience, and governmental aids into local programs for the common good.

9. Forest Service - The name "Forest Service" was first applied on February 1, 1905, in a letter written by James Wilson, Secretary of Agriculture. The name "Forest Service" was also used by the Agriculture Appropriation Act of 1906. Many of its functions were carried on earlier under different organizational titles.

UNIT: Introduction
TOPIC: Farm Organizations and Service Agencies
(Information Sheet continued)

The Forest Service is charged with the responsibility for promoting the conservation and best use of the nation's forest lands. To meet this responsibility, the Forest Service engages in three types of work: (1) management of national forests (2) range and forest research (3) cooperation with states and private land owners. All farmers are eligible to receive these services.

Vocational Agriculture is a service agency. Vocational agriculture courses are taught in approximately 850 secondary schools in Texas. The courses have served youth in on-farm instruction since the establishment of the program in 1917. Vocational agriculture has been enlarged to the extent that it includes Young Farmer and Adult Farmer training. Also, the program offers off-farm training for high school boys and girls who plan to enter nonfarm jobs that require some knowledge and skill in the technical and nontechnical fields of agriculture.

The vocational agriculture teacher assists the farmers in the rural community with their problems. They also work with farmers on committees and in agricultural organizations.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Records

TOPIC: Keeping Farm Records

OBJECTIVE: To lead the student to become familiar with reasons for keeping records and with farm record keeping systems.

REFERENCES:
Required:
1. Information Sheet, "Records".

QUESTIONS OR ACTIVITIES

1. What is the most important reason for keeping farm records?
2. How can records benefit a farmer in making out his tax returns?
3. What are the main pitfalls found in keeping records?
4. What are three major reasons that cause a farmer to keep records?
5. List the type of records that are important to the farmer.
6. Do most farmers use the same method to keep records?
7. Is it just as important to keep crop improvement records as livestock improvement records?

Information Sheet
on
RECORDS

There are almost as many record keeping systems as there are farmers, but several things are basic to all record keeping systems: expenses and income, taxes, and profits and losses.

In order to be able to make more efficient use of records, specific crop records should be kept separately so further management decisions may be made if necessary at a later date.

There are two precautions to offer farmers in regard to keeping records: not keeping records up to date and forgetting items when they have not been written down for several days.

Reasons for keeping records are as follows:

1. Furnishes a systematic procedure for determining the profit and loss from the program in the farming enterprise. Also, it furnishes information for future use.
2. A farmer can compare the results of his program with other programs in the county or previous years' programs.
3. Assist the farmer in discovering weaknesses or strong points in the program so that corrections can be made.
4. Enables the farmer to organize the program by developing desirable habits, attitudes, and appreciation for record keeping.
5. Assist the farmer in setting up budget and goals which may lead to proper credit planning.
6. Furnishes a basis for developing larger programs and developing new crop enterprises.
7. Records are absolutely necessary for tax reporting.
8. Furnishes data for the State and National Crop Reporting Service.
9. Records provide information to help obtain loans.

The types of records that may be kept by the farmers include: (1) inventory, (2) expense, (3) sales or receipts, (4) loss, (5) production, (6) testing, (7) land use, and (8) business agreement.

A farming program cannot live without a system for keeping accurate records. It is true that record keeping requires valuable time that could be used elsewhere on the farm, but record keeping is an indispensable part of the total farming program. Records should be kept primarily for the use of the farmer

UNIT: Farm Record
TOPIC: Records
(Information Sheet continued)

in making improvements in the overall farming program and for tax reporting purposes each year. If money is lost on an enterprise, a good set of records will reveal the cause of the loss. Usually, a farmer will justify the discontinuance of a certain crop program by the use of records.

There are many methods of keeping records, as previously mentioned. The important thing is to use a system that is suitable to the situation. Once the system is put into operation only minor changes should be made. In any system of record keeping the expenses and income should be recorded regardless of the amount involved in the transaction.

Probably the income tax law has caused more farmers to keep records than anything else. The Internal Revenue Service demands cancelled checks and other reliable records that will support the annual tax forms. Farmers who are members of crop improvement programs must keep accurate production records. Crop research and improvement programs and many farm associations require accurate records. In certain cases the farmer may not be a member of an improvement association, but due to the type of farming program in operation it may be necessary that accurate records be kept on the use of agricultural chemicals.

If the farmer participates in any of the USDA governmental programs, it is necessary to keep records in order to complete the various forms that are required by the USDA agency.

Example No. I - Records

Operating and Capital Expenses

Date	Expense Items	Quantity	Price per unit	Expenses		Total
				Cash	Exchange	Cash & Exchange
Totals						

Income From Capital and Non-Capital Items

Date	Income Items	Quantity	Price per unit	Income		Total
				Cash	Exchange	Cash & Exchange
Totals						

Example No. 2 - Records
Inventory of Crops

Description	Date Acquired	Beginning of year			End of year		
		Amount	Unit Price	Value	Amount	Unit Price	Value

Inventory of Machinery, Equipment, and Improvements

Description	Date Acquired	Purchase Price	Cost Less Salvage	Total for Each Kind			
				Value Beginning of year	Depreciation Method	Current Depreciation	Value at End of year

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Records

TOPIC: Using Records in Farm Management

OBJECTIVES:
1. To become familiar with the use of farm records
2. To become familiar with different systems of keeping farm records.

REFERENCES:

Required:
1. Information Sheet, "Records and Management".

QUESTIONS OR ACTIVITIES:

1. How should a farmer select the kind of records he will keep?
2. Why are some farmers losing money on some enterprises and never know it?
3. How can a map tell a farmer what herbicides he will probably need next year?
4. How can a mapping system tell a farmer whether or not land levelling is profitable?
5. How can maps be used to select crops that should be planted and where?

Information Sheet
on
RECORDS AND MANAGEMENT

How can records be used?

Why keep crop records?

These are two questions that many people have tried to answer. At this point more will be found out about these two questions, but this may not be the exact answer to fit every farm. With some changes, the farmer can fit the answers to his farm.

In order to answer the first question it is necessary to base management decisions for farm records on the questions listed below:

1. Is more labor needed?
2. Do I need to buy new equipment or more equipment?
3. Can I grow a more profitable crop?
4. Will a certain crop do better on one field?
5. Can I grow another crop where my main crop does not yield well?
6. What herbicides should I use and what rates should I apply?
7. What insecticides should I use?
8. What fertilizer and rate gives me the most economical yield?
9. What should I plant?
10. Where should I plant?
11. What type of cultivation should I do and when?
12. What yields can I expect?
13. What rotations give the best results?
14. What disease problems will I have?
15. What varieties of crop yield best and what should I plant?
16. Is irrigation needed and how often?
17. Is land levelling profitable?

This is a fairly long list, but most farmers ask themselves many of these questions several times a year. The answers to these questions do not come easy, but if the farmers have records of what was done, where, and when, then they will have a basis for making decisions for everything that they do.

As was mentioned earlier, there are many systems for keeping records, but one of the best and simplest methods to keep and use is a map system. This system is currently being used by a very large, successful Texas farm. The manager of this farm relies on the maps for his management decisions and not on his memory.

UNIT: Farm Records
TOPIC: Records and Management
(Information Sheet continued)

As was stated earlier, this is a simple method, and all that is needed is a map of the farm, some colored pencils, and a general idea about what needs to be done in order to get a crop harvested. The map on the following page is used as an example. Each field is outlined and numbered, with the larger areas representing pasture land.

This year the land was fertilized in much the same way as it was fertilized in the past. So for field #1, 300 pounds of 10-55 is applied; on field #2, 150 pounds of anhydrous ammonia is applied, as recommended by soil tests.

Each of the fields is outlined with a different color pencil, and the map is dated to show the day the fertilizer is applied. Also, the meaning of each color should be written on the map. When the farmer starts fertilizing a field, he takes the map with him. So, when he finishes he can take a pencil and color field #1 before fertilizing field #2.

This type of coloring system may be used for every practice that is done from land preparation to crop yields. Use a different map for each day that work is being done in the fields.

This is very important for two main reasons:

1. If a herbicide is used on several fields and a hail storm comes, or something else happens to destroy the crop, a farmer needs to know the type of herbicide that was applied, when it was applied, and what crops can be planted on this land. By looking back at the daily record of maps, the farmer can very quickly find what is needed.

2. Since successful farming is the objective, the farmer needs to know what has been done and what is needed to get the most profitable yield from the crop. After a year or two, it is easy to look back through the maps and tell what cultivation practices, what fertilizer rates, what herbicides, and what rotations give the best yield for that particular block of land.

These maps have other uses. They make it easier to farm plots of ground that are not square or rectangular-shape. Most farmers would like to eliminate point rows and short rows from their fields because much of the productive land will vary in soil type over a large area. For these reasons the smaller blocks have been levelled and squared so that rows will be of equal length and can be cultivated with six- or eight-

UNIT: Farm Records
TOPIC: Records and Management
(Information Sheet continued)

row equipment more easily. Also, the soil type in each block will be more uniform. Therefore, by using a map one can determine what levelling, fencing, and other approved practices should be done in the future. To put it more simply, the use of maps will help the farmer determine what the farm should look like in 5 years.

One of these maps can be made very easily. It should be drawn on a piece of paper and several copies printed. However, most printers prefer having the map drawn on vellum, which is a real high quality paper. This is to the farmer's advantage also, because as his farm plans change, he can erase on the vellum those parts that have changed during the year and redraw only part of the farm. The cost of these maps currently will be around one or two cents apiece, depending mainly on the number of maps printed.

As was stated earlier, this is a very simple and accurate method of keeping farm records, not only from day to day, but year by year. But it is like any other record keeping system, it should be done every day. If a farmer tries to remember everything accomplished on a crop last year, a mistake may cost the farmer his crop.

Many farmers are satisfied with their farming, because the farm as a whole shows a profit. By breaking the records down to each enterprise, a farmer can tell which is showing a profit. If one is showing a loss, he can locate the trouble and change his methods or drop the enterprise completely.

Many farms have several enterprises, such as livestock, crops, poultry, and maybe a few acres of vegetables. The farm as a whole could show a profit even though money was being lost on the poultry enterprise, as an example.

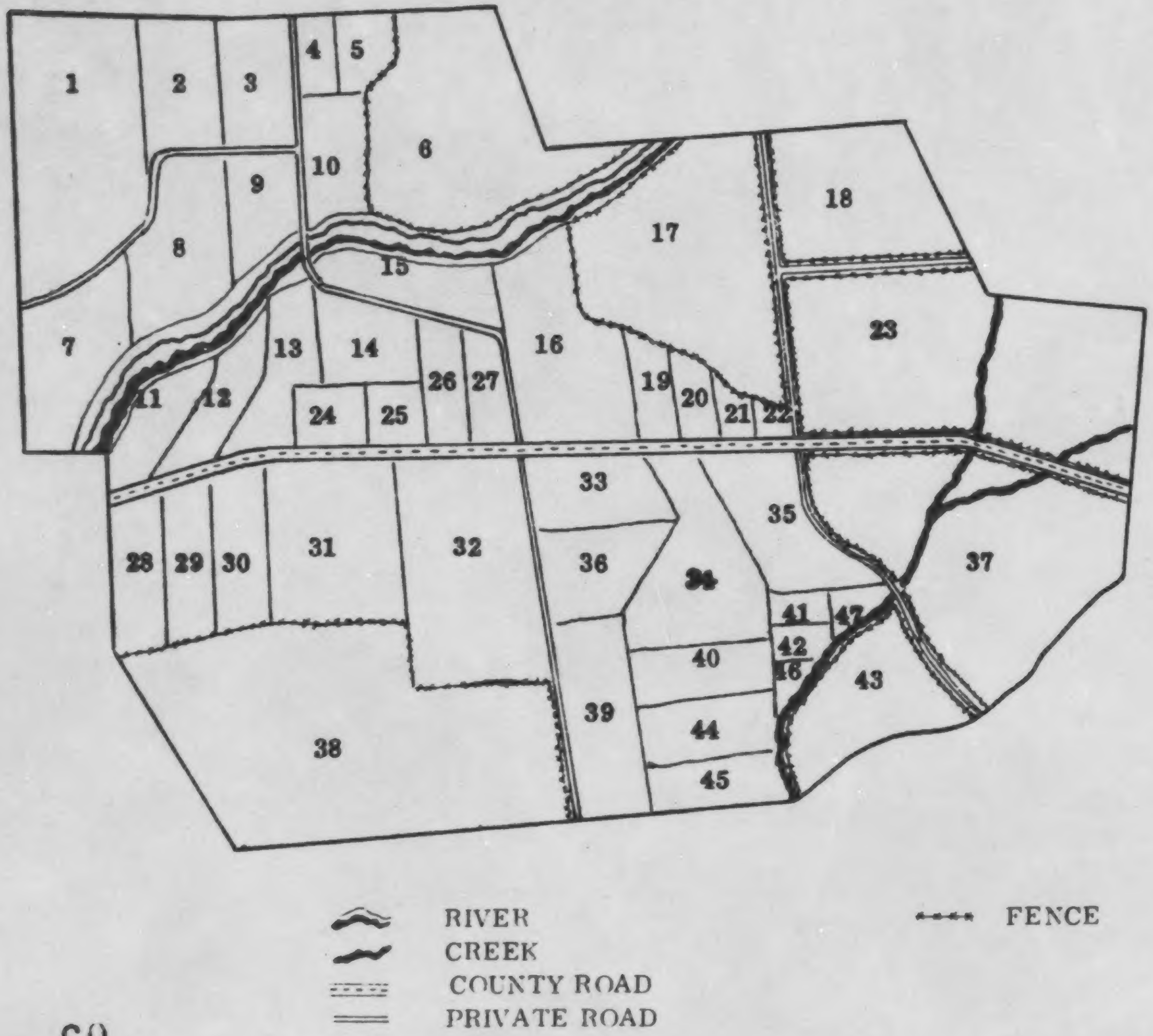
To be of the most value, this farmer should break down his records on livestock to its lowest form. If he has beef cattle, records should be kept on them. If he feeds out some steers, records should be kept on them. If he has breeding cattle, records should be kept on them. A crop record should be kept on each crop, such as corn, cotton, oats, wheat, or grain sorghum.

A system of records for each enterprise might become complicated, but it will pay dividends in many ways. One is by having records to show a banker or any lending agency, if the farmer needs money to enlarge or expand. Another is for income tax purposes. If a farmer has a good set of records, he should be able to give reasons for

UNIT: Farm Records
TOPIC: Records and Management
(Information Sheet continued)

any deduction made.

If a young farmer starts keeping records when he starts his farming program, record keeping will be easy. If he waits until his program is large, he might have some trouble. Therefore, it is a good practice to keep records on all enterprises from the time they are started.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RIVER
CREEK
COUNTY ROAD
PRIVATE ROAD
FENCE

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Machinery - Maintenance and Operation

TOPIC: Proper Use of Machinery and Equipment

OBJECTIVE: To understand the importance of practicing safety while operating farm machinery.

REFERENCES:

Required:

1. Machines for Power Farming, Stone and Gulvin, pp. 116-119 and 503.
2. Information Sheet, "Proper Use of Machinery and Equipment".
3. Mechanics in Agriculture, Phipps, pp. 14-39.

QUESTIONS OR ACTIVITIES:

1. How important are safety practices around farm machinery and equipment?
2. How can safety hazards be eliminated around farm equipment and machinery?
3. Why is it important to use correct operation procedures while operating farm machinery?
4. When climbing on a tractor what precautions should the operator observe?
5. What are some common hazards that cause accidents around the farm?
6. What is the cause of many accidents around the moving parts of farm machinery?
7. What causes most of the fatal farm accidents?
8. What are some of the precautions that should be observed when operating a tractor?
9. What are the safety precautions that should be observed when handling tractor fuels?
10. What are the hazards found around farm buildings that cause accidents?

Information Sheet
on
PROPER USE OF MACHINERY AND EQUIPMENT

Farming is considered the third most hazardous industry in the United States. Why is this true? Tractors and equipment sitting around will not hurt or kill anyone, that is, until someone starts them or uses them.

Therefore, a person has to come to the conclusion that people operating farm machinery cause accidents and not the machinery. Most farm accidents are caused by operators being careless, while the rest are caused by operators not knowing how to operate machinery properly. Most accidents caused by the latter are the result of not paying attention to safety devices on the machinery. A good example of this would be power take-off shields. Many farmers and machinery operators remove the shields so that they will not get in the way. But farmers who have had their pants or shirt sleeves hung on a power take-off will keep the shields on their equipment. The following precautions should be observed:

> Do not wear clothing that is frayed around the edges, has tears, heavy cuffs, or bulging pockets, or fits loosely.
> Do not wear heelless shoes that have loose soles. Such hazards may cause injuries when climbing on and off the tractor or equipment.
> Do not mount a muddy or greasy step or platform on tractor and equipment. Wet platforms and steps may contain ice or snow during the winter months.

The tractor is considered the most hazardous piece of machinery around the farm. About one-half of all fatal accidents are caused by careless operation of the tractor. Tractor operated equipment is also dangerous if safety precautions are not observed. There are approximately 50,000 accidents per year in which the tractor is the cause of the accident; 1,000 of these are fatal. Some practices to observe when operating a tractor are:

> Cabless tractors are designed for one operator; therefore, extra riders should not be allowed on the machine or most equipment.
> Tractors operated at the proper speed can be braked and turned properly without endangering the life of the operator.
> Tractors without power-assist shifts should be stopped to make the gear change. They should be left in gear when going down hill.
> Pulling heavy loads uphill and working around slopes are considered dangerous situations. If the load is not correctly balanced, the machine may tip over backwards. If the machine is being used on or around slopes, the machine may roll over on its side.

UNIT: Farm Machinery - Maintenance and Operation
TOPIC: Proper Use of Machinery and Equipment
(Information Sheet continued)

> If a tractor is refueled properly, the job is always considered safe. These two important precautions must be observed: the engine must be stopped, and the no smoking practice must be observed.

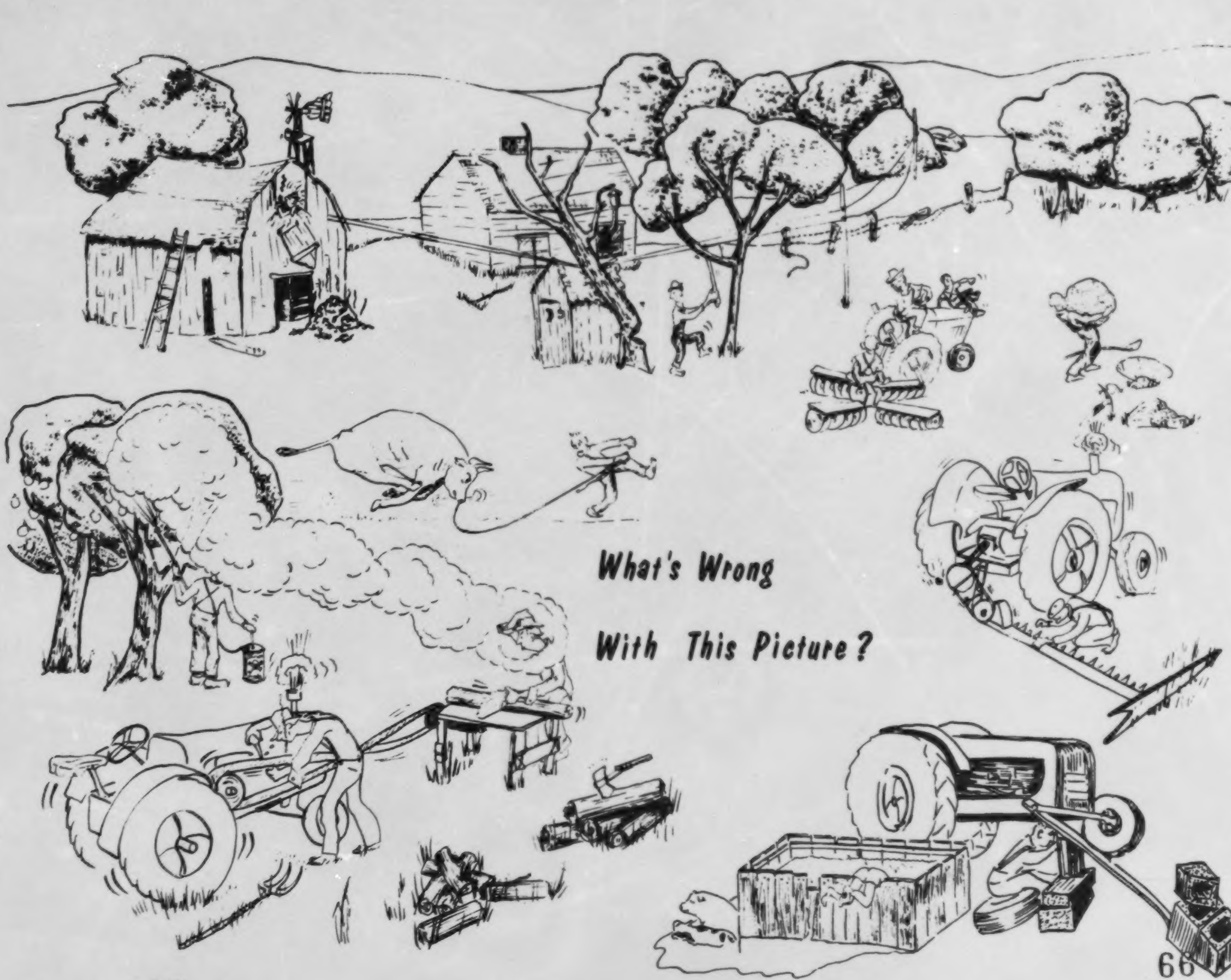
By knowing these things and by keeping equipment in good repair, farmers could avoid most of the accidents that occur on the farm.

A good place to locate information on the operation and care of farm equipment and machinery is the "Owner's and Operator's Manual" which is published by farm machinery companies and sold with each piece of equipment that farmers buy. The information in these manuals is the result of many years of experience in building, repairing, and operating the machinery. The farmer should read the manual, follow instructions very closely, and keep the manual so it can be used as a reference for years to come.

Machinery costs are high now and they are going up. It is to the farmer's advantage to properly take care of his equipment and operate it according to manufacturer's recommendations. If the farmer does this, farming could very easily become one of the safest occupations, instead one of the most hazardous.

The following unsafe practices cause many farm accidents:

1. Failure to stop tractor when servicing it
2. Wearing loose clothing around power machinery
3. Failure to place tools in tool kit after using them on the tractor
4. Working in front of a mower without stopping the tractor engine
5. Children riding on a tractor
6. Turning the tractor sharply at high speed
7. Harrowing with tractor rear wheels in narrow position
8. Tractor driver not watching where he is going
9. Working beneath the tractor make-shift jack or hoist
10. Failure to keep wheel guards mounted on tractor
11. Pulling heavy loads without proper wheel weights
12. Driving the tractor on public roads without using precaution signals



What's Wrong

With This Picture?

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Machinery - Maintenance and Operation

TOPIC: Maintenance of Power Machinery

OBJECTIVE: To become familiar with farm power and machinery maintenance.

REFERENCES:

Required:

1. Mechanics in Agriculture, Phipps, pp. 383-486.
2. Information Sheet, "Maintenance of Power Machinery".
3. "Tires for Farm Equipment", Vocational Agriculture Service, Illinois, pp. 1-19.

QUESTIONS OR ACTIVITIES:

1. How can a farmer keep power machinery maintenance to a minimum?
2. What type of on-the-job repairs should the crop farmer make himself?
3. What are some of the maintenance costs involved in prevention and on-the-job repairs?
4. Are records of equipment servicing necessary for prolonging the useful life of equipment?
5. What knowledge should the tractor driver have, other than knowing how to drive a tractor?
6. Why is it important that the air cleaner be checked?
7. What are the two types of air cleaners?
8. How does overheating affect the crankcase oil?
9. What are the main causes of rust in the cooling system?
10. How often should the tractor be greased?
11. Why is it necessary to remove water from the diesel fuel after the tractor has not been in operation for several hours?
12. Define the meaning of viscosity of oil.
13. List five factors that determine the frequency of oil change.
14. What are several causes of tire damage on farm power machines?

Information Sheet
on
MAINTENANCE OF POWER MACHINERY

In order to prevent costly "breakdowns" and to keep maintenance costs to a minimum, the tractor operator must do more than operate the tractor properly. He must service the tractor daily and then operate it according to the instructions found in the Owner's and Operator's Manual.

The Owner's and Operator's Manual contains information regarding how and when to service the various parts of the tractor. Also included in the manual is information regarding adjustments and repairs that can be made in the field.

Making minor repairs in the field is very important because the farmer can save valuable time by not having to take a tractor or piece of power machinery to town to get it repaired. These repairs are referred to as on-the-job repairs and may include such things as: setting distributor points, replacing spark plugs, packing and replacing wheel bearings, timing the motor, replacing worn ignition system wiring, soldering radiators, and adjusting valves. Basic mechanical skills are required for these repairs, but if the tools are available, these repairs can be accomplished in a short while. Most of the know-how that is required for these jobs can be found in the Owner's and Operator's Manual.

Farm equipment operators need to be familiar with the area of "trouble shooting". This is simply being able to locate problems in machinery and make necessary repairs that will help prevent major breakdowns.

Farm machinery, like automobiles, is not going to last indefinitely. This machinery will eventually wear out and become expensive to maintain. The farm operator will need to be able to recognize when the cost of upkeep and repairs exceeds the usefulness of a specific piece of machinery.

Needless to say, if an operator is going to make a decision concerning a particular machine, he must have some type of records. The cost of maintenance of power machinery affects the efficiency of the farm. The good operator will keep some type of record on each power unit on his farm. There is no better way to reduce maintenance cost than to do an excellent job of servicing and operating the equipment.

The regular repair season for power machinery is usually in the late fall or early winter months. But, it pays to maintain and repair power machinery throughout the entire year. The cost of a breakdown at a critical period of the crop producing season may be greater than repairing the machine in order that it may be put back

UNIT: Farm Machinery - Maintenance and Operation
TOPIC: Maintenance of Power Machinery
(Information Sheet continued)

into operation. Delays in planting, controlling weeds and insects, and harvesting may mean a great loss in income from a crop.

It may be necessary to check the machine and make a list of repairs needed, after the machine is no longer in operation. During the slack season (fall and winter months) parts should be purchased and repairs made so the machine can be put into use at the time it is needed for the future cropping season.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Machinery - Maintenance and Operations

TOPIC: Maintenance of Equipment

OBJECTIVE: To make the student aware of the importance of and methods of taking care of farm machinery through preventive maintenance and minor repairs.

REFERENCES:

Required:

1. Information Sheet for "Maintenance of Farm Equipment".
2. Machines for Power Farming, Stone and Gulvin, pp. 167-168, 189, 200, 221-231, 238, 247-248, 254, 265, 277-279, 287, 309, 328-330, 350-351, 405-409, 420-421, 428-429, 448-449, 489-491, 506-509, 533-548.

QUESTIONS OR ACTIVITIES:

1. What is the most important thing that a farmer can do to increase the usable life of his equipment? Why?
2. Should the farmer try to repair his equipment?
3. How can the farmer control his equipment maintenance cost?
4. How often should bearings on disc plows be greased?
5. When should all bearings on all farm machinery be greased?
6. Why is it important that all lubrication points be located on pieces of equipment?
7. List the jobs that are required to maintain tractor plows.
8. What are the management practices in caring for a rotary cutter?
9. What is the most important management practice in caring for a fertilizer distributor?
10. What are three things that prolong the life of the mower?
11. What are the parts on a side-delivery rake that require continuous repair?
12. Why should the tension on a bale chamber be released at the end of a day?
13. What requires most maintenance on a forage harvester?
14. Why is it important to keep the combine lubricated?
15. List six important field adjustments for a cotton stripper.
16. What is the best way to learn to operate a cottonpicker?

Information Sheet
on
MAINTENANCE OF FARM EQUIPMENT

All implements used on farms should be inspected regularly for worn parts. If a part is located that is badly worn it should be replaced because not only could it break and cause a breakdown, but one worn part may cause increased wear on other parts. To be able to locate possible trouble spots and lubrication points be certain to read the owner's manual for each piece of farm machinery and then operate and maintain the equipment the way the owner's manual suggests.

If the owner's manual is not available, the equipment should be checked weekly, monthly, and yearly for needed repairs. One farmer may own and operate a piece of farm machinery twice as long as his neighbor. It is a known fact that many types of equipment must be parked under a shed instead of leaving it exposed to the many changing weather conditions. All machinery will require less repair and upkeep if it is stored under a shed while not in use. For example, a combine should not be left in the field or parked under a tree during the many months it is not in operation.

Most manufacturers give information in the owner's manual on preparing certain machines and equipment for inactive duty. Farm equipment that is self-propelled should be serviced before storing. Any piece of equipment should be free of chaff, dirt, and other materials that may cause rust or damage to machinery parts.

Preventive maintenance is absolutely necessary if the farm operator is to use the machine and equipment to its fullest advantage. It can do the following three things:

> Reduce failures - The possibility of failure may not be eliminated, but it can be reduced. In order to keep the machine operating at planting and harvesting time, perform maintenance jobs at the end of the work day or at the beginning of the day.
>
> Reduce operation cost - Preventive maintenance can reduce operation cost. Gallons of fuel can be saved, and extra horsepower added with an engine tune-up. The replacement of fuel and oil filters may save both fuel and wear on the engine.
>
> Keep equipment in safe condition - In order for a machine to be safe for continuous operation, it must be kept in as near perfect shape as possible. For example, the brakes should be checked regularly to prevent the machine from careening out of control. Badly worn parts not found in time may break, causing damage to other parts of the machine.

UNIT: Farm Machinery - Maintenance and Operations
TOPIC: Maintenance of Equipment
(Information Sheet continued)

Things to do to keep the machine operating are:

Study the operator's manual.
Do daily maintenance either after the work day or before starting the day.
Look over the engine and total machine before trying to start it. Damaged or broken parts may be found.
Start the engine and operate it until it is warm. It will begin operating better under a load if this procedure is followed.
Shut off a hot engine after it has operated without a load.
Watch the dial gages on the instrument panel while the machine is operating.
Tighten all bolts and nuts.
Service the machine properly each day it works.
Operate the machine at proper speeds.
Contact a serviceman for repairs that cannot be handled in the home shop.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Structures and Equipment

TOPIC: Maintenance of Farm Structures and Equipment

OBJECTIVE: Lead student to realize that farm structures and equipment are very important in the efficiency of a farm.

REFERENCES:

Required:

1. "Planning Machinery Protection", American Association for Vocational Instructional Materials.
2. Information Sheet, "Maintenance of Farm Structures and Equipment".

QUESTIONS OR ACTIVITIES:

1. What should govern the amount invested in farm structures?
2. List four types of building materials used in farm structures.
3. How should farm equipment be operated?
4. What is the main reason for protecting machinery?
5. What causes rust on machinery?
6. Give the harmful effects of the sun's rays on machine parts.
7. Can wind harm farm machinery and buildings? How?
8. Is canvas-duck and plastic considered as year round-protection covers? Why not?
9. List three methods used to protect farm machinery.
10. List by steps the procedure for planning a structure for equipment storage.
11. List the major causes of equipment depreciation.

Information Sheet
on
MAINTENANCE OF FARM STRUCTURES AND EQUIPMENT

Very few farmers have the opportunity to plan and erect the structures on their farms. Most farmers buy a farm and, because of finances, have to use existing structures as they were.

Some uses of farm structures which are related to row crops are storage bins, curing and drying bins, mixing bins, and structures to house machinery used in producing and processing row crops. Some farms have special structures for storing fuel, fertilizers, and chemicals for all uses.

The use to be made of each building or structure will, to some extent, govern the type and size of structure. Most farms do not have a sufficient number of structures, so they must use the buildings or structures for more than one purpose. A few farms have too many structures. The maintenance or upkeep is an added cost in the farm operation, even if the buildings can be depreciated each year on the tax form.

The value of farm structures and equipment varies from a few dollars on some farms to many thousands of dollars on others. The following questions may be asked: Is the farm with a few dollars invested in farm structures and equipment as efficient as the farm with thousands of dollars invested? Which farmer realizes the greatest amount of profit? What about a farmer with a lot of rundown, dilapidated structures and equipment?

The variation might be caused by a number of things. The man with a few dollars invested may be just a beginner. His farming enterprises may not require the more elaborate structures and equipment. He might be entering the farming business on a small scale and may desire to learn the business as his farming enterprises become larger.

On the other hand the man with thousands invested might use the structures and equipment as a means of satisfying his ego. He might want to use it as a show place where he could take his friends. However, the structures and equipment may be helpful in making a profit from his farming enterprises. If the structures and equipment are used in a calculated way to save labor and time, they are economically feasible to own because they will pay for themselves in a relatively short time.

As the man with the lesser investment grows and prospers, he probably will invest more money in better, more spacious structures and in more efficient equipment.

UNIT: Farm Structures and Equipment
TOPIC: Maintenance of Farm Structures and Equipment
(Information Sheet continued)

Even if a man starts out with a small investment in structures and equipment, these must be maintained and repaired as the need arises. A farmer should have or develop some ability as a handyman in order that he can make small repairs. If good methods of maintenance are used, the repair jobs should not be too great.

The first thing to consider is which materials were used in the construction of the structures. There are several kinds of structures. Some are:
Masonry
Frame or wood
Metal

The masonry structures made of brick, concrete block, or tile have a high initial cost but the maintenance should be low for several years.

Frame or wood structures do not cost as much to construct, but the maintenance cost starts soon after it is built. Some maintenance jobs are painting, treating for termites, keeping surrounding area drained, keeping loose boards nailed down, and replacing damaged material.

Metal structures are usually made of sheet metal or treated post. This type of structure is less expensive than wood structures, and maintenance is usually low for several years. Many people do not like the looks of the metal structures, especially if they are near the farm house.

If the metal structure will serve the purpose and is not objectional because of its proximity to the farm home, it is probably the best buy because it is the most economical type of building from the standpoint of construction, maintenance, and repair.

For the most economical maintenance, all equipment directions should be followed according to the recommendations that are found in the manufacturer's service and maintenance manual. It is absolutely necessary that harvesting machines and equipment should be protected from conditions that cause metal to rust, paint to fade, wood and fabric parts to decay, and rubber to soften.

One of the biggest problems in having wood constructed frame buildings is termite damage. Termites will move through the cells of a concrete block foundation and enter the wood area. Termites are treated by using creosote or copper naphthenate under pressure. Treated lumber and posts should be used when repairing barns, equipment sheds, large feeders, and other structures. Wood preservatives can be applied by using a paint brush, but this method of application is not as effective as applying the preservative under pressure.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Structures and Equipment

TOPIC: Building and Maintaining Farm Fences

OBJECTIVE: Lead the student to realize the value of fences and how to build and keep them up.

REFERENCES:

Required:

1. Information Sheet, "Building and Maintaining Farm Fences".

QUESTIONS OR ACTIVITIES:

1. Name two kinds of fences.
2. Why should fences be planned?
3. List the most important steps used in planning a fence.
4. What priorities should be considered in planning a permanent fence?
5. What is the meaning of a design number 1047?
6. Give the pulling strength on a well-constructed fence.
7. How can fence posts be made more durable?
8. When laying out a fence, how far apart should the alignment be set?
9. What type of extra support should be used for dividing fence lengths more than 40 rods long?
10. List the tools commonly used for building fences.

Information Sheet
on
BUILDING AND MAINTAINING FARM FENCES

Farm fences are necessary for many reasons. Some of the more important reasons are:

Provides a convenient method of rotating pastures which may increase grazing capacity as much as 25 percent.
Enables the farmer to use harvest crop land. For example, livestock may graze the grain sorghum or corn fields after harvest.
Protects the animal against vehicle traffic on roads, highways, and railroads.
Protects crops from livestock throughout the maturing season.
Eliminates the need for extra livestock herders and helpers, requiring less management time.
Provides a way to separate different kinds or classes of animals. Growing heifers can be kept apart from the bull until they reach a mature breeding age (fifteen months or more).
Serves as a system to control animals while they are being treated for pests and diseases or for handling animals for other purposes.
Reduces hazards such as poison plant and bog areas.
Protects new established pasture or areas that are being developed for pastures.
Provides a method of establishing permanent boundary lines.

A properly planned fencing program will save time and money. A good plan will also eliminate many problems on a farm where there are several head of livestock. However, there are certain crop areas that do not have the problem of fencing; only the pasture land in these areas are fenced. A well planned fence will usually last longer than a hastily planned fence, and it gives a more efficient use of the land.

Steps in planning a fencing layout are:

Use an aerial map to trace the boundary lines and farm layout. This map may be available from the Soil Conservation Service. If this type of information is not available, make a sketch of the farm.
If a land capability map is available from the Soil Conservation Service, fence lines may be plotted according to land use and productivity. Land class is also shown in the capability map.
If possible, plan straight fences around all fields and pastures. Also, fences should be parallel to streams and gullies. Access to streams,

UNIT: Farm Structures and Equipment
TOPIC: Building and Maintaining Farm Fences
(Information Sheet continued)

ponds, and tanks should be provided also.
Plan the fence to set in on the property at main highway entrances. Permanent fences are planned for boundary lines and most permanent pasture areas. The plans should show the proper location of gates, cattle guards, and other entrances. It should also show lanes and roads.
If priorities were considered in fence planning, the following would be used:
Plan a fence around the entire farm.
Plan a fence around permanent pastures.
Plan a fence around permanent watering locations.
Plan a fence for all lanes and roads.

The kind or type of fence constructed on a farm depends largely on the use of the enclosed area. Such factors as the kind of pasture (permanent or temporary), kind of animals, ease of handling animals, size of confinement area, predator problem, pasture problems (type of plants, bogs, and eroded areas) and cost will partially determine the kind of fence that will be constructed. Some common kinds of fences are:

Board - Board fences are commonly used around the farm home (house) and around barns and sheds. They may be known as lot fences. Treated lumber is too expensive to take the place of wire for general fencing jobs on the farm. Lumber and posts that are pressure treated with a preservative will last about as many years as a wire fence. Lumber that is soaked or dipped at home will last 5 to 15 years. Boards 1 to 2 inches thick and 6 to 8 inches wide are commonly used for fences. Fencing lumber is either sold by the board foot or running foot.

Woven Wire - This type of wire is used for small animals such as sheep, swine, and goats and a mixture of small animals with large animals. It may be called an all purpose fence if it is combines with barbed wire. The most commonly used style numbers are: 1155, 1047, 939, 832, and 726. The number of horizontal wires is represented in the first two numbers of a four digit number and in the first number of a three digit number. The last two numbers represent the height of the wire. For example, woven wire fencing No. 1047 has 10 strands of horizontal wire, and it is 47 inches high. This type of fencing is used mainly for sheep, goats, and hogs.

Woven wire poultry fencing or poultry netting is made in two styles, 2158 and 1948. Chick netting is found in 2672, 2360, and 2048. The first two digits are the number of lines or horizontal wires, and the last two numbers are the heights. These styles of fencing may be bought in 10-rod rolls.

UNIT: Farm Structures and Equipment
TOPIC: Building and Maintaining Farm Fences
(Information Sheet continued)

Barbed Wire - Most common barbed wire fences consist of 3, 4, and 5 strands of wire. The two most commonly used wire sizes are 12 1/2 and 14 gauge. Barbed wire may be purchased with either 2 or 4 barbs. A standard roll of wire is 80 rods.

Barbed wire is often used with woven wire (bottom and top of fence) to reinforce the woven wire fence. Most large animal pasture fences are constructed of barbed wire.

Electric Fence - An electric fence is constructed of either smooth or barbed wire. This type of fence is used to supplement the more permanent type of fence. Usually the electric fence is considered a temporary type of fencing. Cattle, horses, hogs, and sheep may be controlled by two or more wires connected to temporary holding insulators and a controller (fence charger). The most popular sizes of wire are 12 1/2 and 14 gauges.

The three most commonly used posts for fences are wood, steel, and concrete. However, a fiberglass post is being marketed and is reported to have a long life expectancy. More wooden posts are used in the Southwest than any other kind, but the use of steel posts has increased in the last few years. Some ranchers are using both wooden and steel posts in fences.

The durability of wooden posts varies depending upon climatic conditions, amount of heartwood, kind of wood used, whether the posts are treated or untreated, and the method of chemical treatment used. The most popular wooden posts in Texas are ashe juniper (cedar) and treated pine. Some farmers, however, still use split post oak posts. Untreated cedar posts have a life expectancy of 15 to 25 years, and pressure treated pine posts have about the same length of life expectancy. Untreated pine posts are not recommended because of their short life expectancy, three to five years.

Two methods of treating pine posts are soaking and pressure treating. Posts soaked in a preservative will last from 15 to 20 years. Pressure treated posts have a longer life expectancy. Creosote, pentachlorophenol, and copper naphthenate are the preservatives most often used.

The three kinds of metal posts manufactured are the "A" bar, studded "Y", and the studded "T".

The studded "Y" and "T" posts are made of thicker metal; therefore, they have

UNIT: Farm Structures and Equipment
TOPIC: Building and Maintaining Farm Fences
(Information Sheet continued)

a longer life expectancy. One advantage of using metal posts is that they serve as a ground for the fence, thus provide protection from lightning. They are also fireproof.

Concrete posts are durable, but they are very heavy and are subject to breaking and weathering.

The type of soil, location of posts (wet soils, hillsides, and on the contour), and climatic conditions influence the size of wooden posts to use in the fence. General recommendations of diameter and length of wooden posts are as follows:

Kind of Posts	Diameter	Length
Line	3-5"	6 1/2-7 ft.
Corner and brace	4-6"	6 1/2-8 ft.
Gate	6" or more	7 1/2-8 ft.

There are several types of fence fasteners. The U-shaped and L-shaped staples are used to fasten wire fencing to wood posts. The U-shaped staples are usually made of number nine gauge wire and range in length from 3/4 to 2 inches. L-shaped staples are in lengths from 1 1/4 to 2 inches. Staples can be purchased either galvanized or ungalvanized. The length of staple used depends on the hardness of the posts. For example, a 7/8 inch U-shaped staple may be used in hard cedar, whereas a 1 1/2 staple is used in a pine treated post. Galvanized wire fasteners are used to connect wires to steel posts. Galvanized steel wire is used to fasten line wires to concrete posts.

Before laying out a fence line, the right-of-way should be cleared of all obstructions, and if the terrain is level the following method may be used:

> A stake about seven feet tall is set in the ground at each end of the fence line. The stake should be vertical with the ground level and driven into the ground deep enough for it to be steady. A white cloth is tied to the top of each stake.
> Stakes are aligned at 100 feet intervals between the two end stakes. One person stands at one of the end stakes and aligns the interval stakes, which are carried by another person. A tall stake is used for sighting and aligning, but a much shorter stake is used to mark the 100 feet intervals.

For laying out lines in hilly or valley areas the following procedure may be used:

UNIT: Farm Structures and Equipment
TOPIC: Building and Maintaining Farm Fences
(Information Sheet continued)

Long stakes with a white cloth attached to the tops are driven at each end of the fence line.
Two stakes with white cloth tied to the tops are placed about 10 feet apart at the top of the hill, or at the lowest point in a valley.
The two center stakes are aligned from one of the end stakes.
The alignment of the center stakes is then checked from the other end stake. It may be necessary to move the center stakes several times before they are aligned. A person sighting at both end stakes will speed up the aligning process.

For areas that are covered in underbrush use the following system:

A pole 15 to 20 feet in length is set in the ground at the end of the fence line nearest to the underbrush. The pole should be long enough to be sighted from the other end of the fence and should be vertical to the ground.
A second stake is aligned with the end stakes as far into the underbrush as can be sighted.
Underbrush is cleared between the stakes that are in the underbrush.
If necessary other stakes are aligned in the underbrush before clearing more brush.

Holes for anchor or corner posts should be 3 1/2 to 4 feet deep. The depth depends upon the type of soil posts are set in. Posts set in concrete can be placed in shallow holes. Concrete should be allowed to dry before attaching any wire. A brace post assembly should be installed after the corner posts or anchor posts are established. A wire drawn fairly tight between the corner posts can be used to align the brace posts, or sighting a straight line between the corners is another method of aligning the brace posts. A brace post assembly usually consists of three posts, two anchor and a brace post. They are joined together with cross braces. Usually the distance between the anchor and brace posts is the length (6 1/2 feet) of a regular post. Metal or wood dowels can be used to secure the cross brace posts to the anchor and brace posts.

The distance line posts are placed apart depends upon the type of fence constructed.

Barbed wire	- 10 to 15 feet
Woven wire	- 15 to 16 feet
Board fence	- 5 to 8 feet
Suspension fence	- 50 to 80 feet

UNIT: Farm Structures and Equipment
TOPIC: Building and Maintaining Farm Fences
(Information Sheet continued)

Stays or twisted wire are used in the place of posts on some fences. Steel posts are used mainly as line posts.

Fence wire may be spaced on posts according to the number of strands or wires that are used in building the fence. A suggested method used to determine the spacing of wires is as follows:

Number of Wires	Fence	Distance Between Wires	Distance from Bottom Wire to Ground
3-Wire fence	48"	16"	16"
4-Wire fence	46"	10"	16"
5-Wire fence	52"	10"	12"
6-Wire fence	52"	8"	12"

Wire can be stretched too much, especially where there is a great variation in temperature. Extremely cold weather causes a wire fence to become tighter. Wire that is stretched too much will have a tendency to move the anchor or corner posts. It is estimated that the pulling strength on a well constructed fence is 3,000 to 4,500 pounds.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Crop Selection

TOPIC: Important Factors Affecting the Choice of Crops

OBJECTIVE: To improve the student's understanding of the factors involved in selecting crops.

REFERENCES:

Required:

1. Information Sheet, "Factors to Consider When Selecting Crops".
2. Plant Science: An Introduction to World Crops, Janick and others, pp. 5, 392-395.

QUESTIONS OR ACTIVITIES:

1. How many of the crops grown in the United States are considered native crops?
2. What are the primary ways that farmers use to get improved varieties of crops?
3. List some of the important factors that affect the choice of crops.
4. What are the main purposes for mass and pedigree selection?
5. Why should a crop be selected according to need?
6. When were most of the present day crops developed? How?
7. Define plant selection.

Information Sheet
on
IMPORTANT FACTORS AFFECTING THE CHOICE OF CROPS

At the beginning of the Twentieth Century two methods of crop selection were being practiced in the United States. The average farmer was still selecting seeds from the most productive plants. For example, corn seed was selected from large ears. The small grain on each end of the ear was rejected due to its lack of uniformity and maturity. The second method of selection involved the selection of crops according to their adaptability to a particular climate.

The early agriculturists selected crops according to their needs. A certain amount of the crops were used for family purposes, and the remainder was placed on the market. This type of farmer relied on his knowledge and skills to provide an adequate supply of food and feed for the family farm.

Today, every farmer depends upon plant breeders and geneticists to improve his crops through the use of up-to-date plant improvement practices that are conducted at experiment stations and research laboratories.

Before a crop is selected in any farming region, the following factors should be considered:

Crop use and market - Is the crop or a portion of the crop to be used as food or feed at home? Is there a market for the crop? There must be a need for the crop being produced.

Climate - Is the crop adapted to the local climatic conditions? How will the temperature, rainfall, humidity, and wind affect the crop? Some varieties produce more than others in some areas where climate is a production factor.

Soil - What type of soil is best suited for the crop? Does the crop require a clay, sand, or silt soil? Is the crop adaptable to an acid or alkaline soil? Can the crop be grown best on a shallow soil or a deep soil? It is recognized that soil is one of the most important factors in choosing a crop.

Labor, machinery, and equipment - Is labor and equipment available to produce and harvest the crop? Hired hand labor and available custom equipment may affect the decision on choosing a crop.

Available acreage - Can the proper amount of land be procured to justify the crop? Small grain production will require a large acreage, whereas vegetable production may require a small acreage.

UNIT: Crop Selection
TOPIC: Important Factors Affecting the Choice of Crops
(Information Sheet continued)

Insects and diseases - What control practices are necessary to grow the crop? Is the crop resistant to certain insects and/or diseases? For example, Acala cotton 1517 WR is resistant to verticillium wilt (a disease caused by a fungus that attacks the plant root). Research is being conducted on the development of a cotton-plant with pigments that will be resistant to the boll worm.

Maturity - If the crop is a cool weather plant, will it mature and produce fruit during hot summer months? If it is a warm weather annual, will it reach maturity before the average frost date in the fall? For example, certain cotton varieties may mature in 95 days, whereas other varieties require 120 days to mature.

Quality of product - The market is based upon the quality of raw materials. Crops are sold according to quality. Why shouldn't the producers select a variety that has quality? For example, if both Lone Star and Acala cotton varieties are adapted to the locality, yet Acala produces 1/8 inch longer fiber, which variety should be selected?

Size of plant and yield - The producer's net income is based upon two factors: quality and quantity. Yield varies with variety; therefore, the producer selects a crop that is a high producer. If Martin's Milo has an average production of 3500 pounds per acre and Plainsman 4010 pounds per acre in the same county, why will the producer select Plainsman?

Cost of production - What net income could be expected from the crop? What phase of production (planting, cultivating, controlling insects and/or diseases, and harvesting) is most expensive? The most expensive phase should be studied to reduce expenses.

The two most important methods used in crop selection are as follows:

Mass selection - Mass selection consists of selecting plants with desired characteristics. The seeds of these plants are mixed and planted together, then another selection is made which eliminates the weaker or undesirable ones. The following two methods are included in mass selection. Grimm alfalfa, Tennessee Winter barley, and Reid's yellow dent corn are examples of mass selection of field crops. Grimm alfalfa and Tennessee Winter barley were developed through mass selection for winter hardness. Open - pollinated corn was selected in the fields and corn cribs. The mass selection method resulted in more uniformity in ears and seed and the filling of tips and butts of ears.

UNIT: Crop Selection
TOPIC: Important Factors Affecting the Choice of Crops
(Information Sheet continued)

Pedigree selection - Pedigree selection is referred to as pure line and individual selection. Individual plants are selected and their performance is recorded. Seed for the individual plant is planted in an individual plant row. Self-fertilization and cross-fertilization can be used in this method. Performance records can plot characteristics such as growth, yield, fruit quality, disease and insect resistance, and lodging. In each selection the best plants are chosen for seed producers.

The main purposes of using mass selection and pedigree selection of plants are: plants are improved through proper selection methods, existing varieties of plants are improved, and new varieties are developed through the two selection methods.

Field crops are also classed according to groups or types. The group or type is determined mainly by the characteristics of the fruit and the general characteristics of the plant. For example, dent corn comprises 95 percent of all corn grown in the United States. It is partially identified by the shrinking of soft starch found in the crown end of the kernel as it ripens. It has also a very starchy endosperm (the starchy part of the seed).

The selection of type depends largely upon the utility value or need for the whole plant, its fruit, or both plant and fruit.

Types of corn are:

Dent corn is grown for livestock feed and cereals.

Sweet corn is usually harvested as human food before maturity. When mature, the kernels are very wrinkled.

Flour corn or soft corn has an endosperm composed of soft starch. The kernels are smooth. It is one of the most popular corns among American Indian tribes.

Popcorn is identified by a small ear containing a hard flinty type of starch in the small kernel. It is used for human consumption.

Flint corn kernels are composed of a hard starch. Flint corn is resistant to the weevil; it makes good corn meal and it is a good livestock feed when the kernels are grown.

UNIT: Crop Selection
TOPIC: Important Factors Affecting the Choice of Crops
(Information Sheet continued)

Pod corn is not considered of commercial importance in the United States. It is believed to be a primitive corn.

Types of sorghums are:

Grain sorghums are used for grain, hay, and silage.

Forage sorghums are used for silage, hay, and pasture.

Sugar and syrup type sorghums are used for hay, silage, pasture, and syrup.

Dual-purpose sorghums - grain and forage types are used for grain, hay, silage, and pasture.

Types of wheat are:

Common wheat is used mainly to make flour. About 95 percent of all wheat grown in the United States is of the common species.

Durum wheat is considered to have the hardest grain of all wheats. It is resistant to drought and black stem rust. This wheat is not suitable for bread flour, but it is used for macaroni and spaghetti.

Club wheat is of minor importance in the United States. It is used for making pastry flour and for exporting purposes.

Poulard, Einkorn, Emmer, Polish, and Spelt types of wheat are not grown extensively in the United States.

Types of barley are:

Six-rowed is the most common type of barley grown in the United States. It is used for malting purposes and feed.

Two-rowed barley is not an important barley crop in the United States. It is preferred in Europe for malting (making of malt) purposes.

Two-rowed and six-rowed refers to the number of rows of grain on the head of barley.

UNIT: Crop Selection
TOPIC: Important Factors Affecting the Choice of Crops
(Information Sheet continued)

Types of oats are:

Common oats are grown for feed and pasture. White oats are the most common in this group.

Cultivated red oats are also an important grain and pasture plant, but they are grown only in the South.

Types of rice are:

Short-grain is grown in California, and it consists of Japanese varieties.

Medium-grain is grown in Louisiana, Texas, and Arkansas.

Long-grain is also grown in Louisiana, Texas, and Arkansas.

All rice is used for food. In many areas rice is selected according to maturity time, production, lodging, and demand. Long-grain may have a higher grain breaking percent when milled than the other two types.

Types of cotton are:

Upland cotton varieties comprise most of the annual cotton crop in the United States. The staple ranges from short to long (3/4 to 1 1/2 inches).

Sea Island and American-Egyptian (Pima) cotton is grown mostly in three states. Sea Island is found in Georgia and Florida and American-Egyptian is found in Arizona.

Some common varieties of corn, sorghum, wheat, barley, oats, rice, and cotton grown in Texas are as follows:

Corn - Over 1,000 varieties of corn are grown in the United States.

Open-pollinated varieties are:

Surcropper (white)

Ferguson Yellow Dent

UNIT: Crop Selection
TOPIC: Important Factors Affecting the Choice of Crops
(Information Sheet continued)

Mexican June

Hastings and Thompson Prolific

Country Gentleman, Crosby, Stowell's Evergreen, and Honey June (sweet corns).

White Rice, Jap Hulless, and Supergold (popcorn).

Corn Hybrids:

Texas 28, 30, 34, 36, and 17 W.

Purdue 39, Purdue 51, Purgold, and Carmel Cross (sweet corns).

Purdue 31, K 4, and Purdue 38 (popcorn).

Grain Sorghum:

Milo-sooner, Double Dwarf, Caprock, Martin's Plainsman, and Redbine.

Kafir - Blackhull, Red, Dwarf, Combine, and Kafir 60.

Feterita - Standard, Spur, and Dwarf.

Hybrid - Texas 660, Texas 601, Texas 611, Texas 620, DeKalb C44a, and RS 590.

Durra (Egyptian corn) - White, Brown, and Dwarf.

Sweet Sorghum (Sorgo):

Sumac, Honey, Atlas, and Black Amber.

Hybrids - Beef builder and silage king.

Grass Sorghums:

Piper Sudan, Wheeler Sudan, and Sweet Sudan S.A., 372.

UNIT: Crop Selection
TOPIC: Important Factors Affecting the Choice of Crops
(Information Sheet continued)

Wheat:

Blackhull, Tascosa, Milam, Ponca, Bison, Concho, Crockett, and Quanah are wheat varieties found in Texas.

Barley:

Wintex, Kearney, Reno, Texas, Rodgers, Goliad, Tunis, Harlume, and Ward are varieties recommended for Texas barley regions.

Oats:

New Nortex, Alamo-X, Bronco, Radar I, Victorgrain, Cimarron, Wintok, Mustang, Moregrain and Surgrain, Alamo, Ferguson 922, and Frazier are varieties grown in Texas.

Rice:

Short grain varieties - Caloro and Asahi

Medium grain varieties - Magnolia, Zenith, and Nato.

Long grain varieties - Bluebonnet 50, Sunbonnet, Texas Patna, Bluebelle, Belle Patna, Improved Bluebonnet, Toro, TP 49, and Century Patna 231.

Cotton:

In 1910 there were 613 varieties of cotton listed in Tyler's report. "Cotton Varieties Planted 1962-1966," a U.S.D.A. publication, reported about 40 varieties planted.

Immediately after World War II about 50 percent of the cotton acreage in the United States was devoted to the strains (plants derived from a variety) from the six following varieties:

Mebane, Acala, Stoneville 2 B, Coker 100, Half and Half, and Deltapine.

Texas cotton varieties with a number of strains developed from each variety are:

Half and Half - Hybrid and Stormproof.

UNIT: Crop Selection
TOPIC: Important Factors Affecting the Choice of Crops
(Information Sheet continued)

Lone Star - Lankart Sel. 57, Northern Star 4 - 11, and Wacona.

Mebane - Qualla, Watson, Texas Special, Mebane 141, Bagley, Western Stormproof, and Lockett 140.

Paymaster - Paymaster 54-B and Paymaster 101.

Rowden - Rowden 40, 41 A, 41 B, and Malone's Rowden.

Acala - Acala 1517, 4-42, 1517 BR, Texacala 5455c, California Acala, and Roger's.

Deltapine - Deltapine 14 and 15.

Stoneville - Stoneville 7 and 3202.

Other varieties and strains - Coker 100, Austin, Rex, Delfos 9169.

Sea Island - Seabrook, Seaberry SXP-30.

American Egyptian - Pima, SI, Supima, Earlipima.

Stormresistant - Blightmaster, Stormmaster, Stormking, Stormproof No. 1, and Stormrider.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Importance of a Good Seedbed

OBJECTIVE: Lead students to realize that a good seedbed is essential to the growth of all crops.

REFERENCES:

Required:

1. Information Sheet, "Importance of a Good Seedbed".

QUESTIONS OR ACTIVITIES:

1. What is the purpose of a seedbed?
2. What is a seedbed?
3. What is the advantage of a firm seedbed?
4. Why should the top 2 or 3 inches of soil in a seedbed be loose and mellow?
5. Why should the bottom 4 or 5 inches of a seedbed be rather finely pulverized and yet fairly firm?
6. Why is a fertile seedbed important?
7. List the characteristics of a good seedbed.

Information Sheet
on
IMPORTANCE OF A GOOD SEEDBED

Soil in which seed is planted is called a seedbed. A good one will receive the necessary moisture, hold the correct temperature for germination, has no competition from weeds, undecomposed plant residue, or soil borne diseases, and the topsoil is loose enough for the seedling to sprout easily. A good seedbed is necessary for a plant to become firmly established so it will not die or be killed in the seedling stage.

How do farmers get this type of ideal seedbed? No farmer ever has an ideal seedbed, but all farmers try to get as close as possible. To do this they will plow the fields to improve soil structure and to keep the field free from weeds. The land will then be replowed to get a good seedbed. If conditions are not right, then the plowing may have to be repeated. Frequently fungicides, nematocides, or other pesticides are incorporated with the soil during one of these plowings. Generally stated, in farming today more money, equipment, and labor is spent in preparing a good seedbed than on any particular crop.

What should a farmer look for in a seedbed? First, the farmer should try to get the topsoil finely pulverized, yet still have a good porous structure. A fine seedbed is needed so that the seeds will make good soil contact and absorb enough moisture for them to germinate. A good rule to follow is that the smaller the seed, the finer the soil needs to be.

The soil should be fine but yet firm enough to prevent rapid drying and should furnish a good growing medium for the tiny root hairs. Normally, this condition should be found in the bottom four inches of a seven inch seedbed. In addition to this, the soil in the upper two or three inches should be relatively loose and mellow. This is important because air needs to circulate around the seed to get maximum germination and optimal seedling growth.

The soil should also be free of trash and growing vegetation, especially weeds. Trash and weeds should be shredded and plowed under as soon as possible following the last crop so that the stalks will have time to decompose before the new crop is planted. (This is not done when the old stubble and trash need to be left on the field to prevent wind or water erosion.) Seedbeds should be fertile to aid rapid decomposition of stalks and to provide young seedlings with adequate nutrients. To obtain best results from fertilizer, the farmer should have soil samples analyzed and then fertilize according to recommendation.

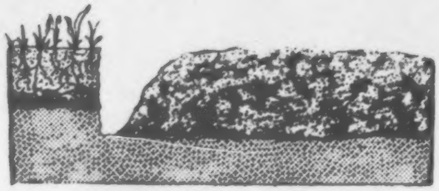
Even if everything mentioned up to this point has been done, a farmer could still lose a crop. The loss may be due to weather, insects, or diseases. Nothing can be done to

UNIT: Land Preparation
TOPIC: Importance of a Good Seedbed
(Information Sheet continued)

control the weather, but precautions can be taken to avoid losses due to insects and/or diseases. If there has been a problem, the farmer should rotate the field with non-susceptible crops or treat with a pesticide that will leave the soil free from insects or diseases.

If a farmer does these things to the best of his ability, buys good seed, and gets a little cooperation from the weather, his crop should come up in a good stand and the seedlings remain healthy until they become established in the soil. This is essential because without a seedling there will be no crop.

CHARACTERISTICS OF A GOOD SEEDBED



SOIL IS :	
FINE , PULVERIZED	SEED IN DIRECT CONTACT WITH SOIL PARTICLES
FIRM	SHOULD SETTLE WITHIN THREE WEEKS AFTER PLOWING PREVENTS DRYING GOOD ROOT HAIR MEDIUM
LOOSE, MELLOW	PERMITS GOOD AIR CIRCULATION AND SEEDLING GROWTH
FREE OF WEEDS AND TRASH	TRASH AND WEEDS SHREDDED AND PLOWED UNDER
FERTILE	ADEQUATE PLANT NUTRIENTS
FREE OF INSECTS	ACCOMPLISHED BY DEEP PLOWING AND FUMIGATION
FREE OF PLANT DISEASES	BY FUMIGATION AND PROPER TILLAGE
LACKING HARDPAN	PLOWING AT VARIOUS DEPTHS
AT A STABLE TEMPERATURE	AIR SPACES ACT AS AN INSULATOR FOR THE SOIL
MOIST BUT NOT WET	MUST HAVE GOOD MOISTURE HOLDING BASE, BUT BE WELL DRAINED

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Row Crop Seedbed Preparation

OBJECTIVE: To lead the student to realize the importance of crop residue disposal and the preparation of a good seedbed.

To lead the student to realize the importance of the proper use of equipment to prepare a seedbed.

REFERENCES:

Required:

1. Farm Machinery and Equipment, Smith, pp. 93-144.
2. Operator's Manual for Equipment.
3. Information Sheet, "Row Crop Seedbed Preparation".

QUESTIONS OR ACTIVITIES:

1. Why is the proper removal of crop residue important?
2. Why is the proper use of the right equipment important?
3. What is primary tillage, and why is it important?
4. Why is a good seedbed important?
5. What are the characteristics of a good seedbed?
6. What is a very important plow used in preparing a seedbed?
7. What is the purpose of the lister-planter?
8. What are the modern methods of seedbed preparation, and why are they used?

Information Sheet
on
ROW CROP SEEDBED PREPARATION

The harvesting of most field crops fails to remove old plant stubble and stalks that make cultivation difficult for future crops. If weed control practices are not followed, large weeds may interfere with seedbed preparation and cultivation of the crop.

Crop residue is the old stubble that is left in the field or that part of the crop that remains on the soil after a part of the crop has been removed by harvesting. Crop residue may be roots, leaves, and stems.

There are several reasons for destroying crop residue other than leaving a clean seedbed. These are:

1. Crop residues and weeds will increase the organic matter in the soil if the residue materials are properly mixed with the soil.
2. The amount of certain plant food elements is increased by the addition of organic matter to the soil.
3. Microorganism growth and action may be improved by mixing crop residues and other plant materials with the soil. The residues serve as a low animal life food.
4. The mixing of fine vegetative trash with the soil tends to pulverize it, making a smoother seedbed. The soil particles clump together in small granules, making a desirable soil condition.
5. Proper crop residue disposal practices may reduce the crop insect population by destroying the winter hiding places.
6. Plant residue reduces the water runoff rate, therefore permitting a more desirable rate of percolation or a better soil permeability. A compact soil zone will cause slow percolation and permit more evaporation of soil water. The roots may not penetrate the hardpan.
7. In most cases air circulation and temperature favorable to plant growth are maintained in a soil that contains adequate humus.

Some form of tillage has been practiced almost since the days of the cave man. Tillage at this time consisted primarily of the breaking the soil so a seed could be planted. Then the wooden plow was developed in Medieval Europe, and, in 1833, the steel plow

UNIT: Land Preparation
TOPIC: Row Crop Seedbed Preparation
(Information Sheet continued)

was developed in the United States. Since that time, many pieces of tillage equipment have been developed so that crops can be produced more efficiently.

Since the middle of the Sixteenth Century, man has tilled the land and prepared his seedbed for three reasons:

1. To improve the soil's physical condition, so seed germination and plant growth will occur more readily.
2. To eliminate weed competition.
3. To improve the soil's chemical and biological condition.

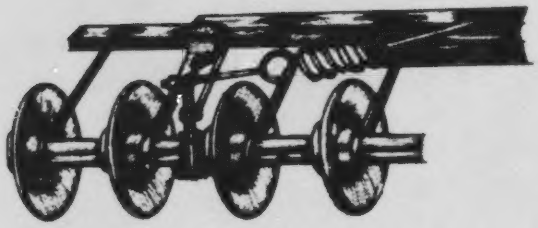
The following factors may determine the best time to prepare a seedbed:

1. The type of crop grown the preceding year may cause the seedbed to be partially prepared during the fall. The tillage load for preparing the seedbed in the spring is reduced and crops can be planted earlier.
2. Weeds may tend to use the nitrates that may be lost due to leaching in heavy rainfall areas; therefore, plowing may be delayed.
3. Certain areas have heavy rainfall which causes a danger of erosion. Late fall or winter plowing is considered inadvisable in such areas.
4. Where wind erosion is a problem the seedbed may be only chiseled in the fall, winter, or early spring.
5. Fall plowing increases the rate by which humus is added to the soil.
6. The process of producing humus (decomposed plant residue) begins when the organic matter is mixed with the soil. In summary the relationship is as follows:

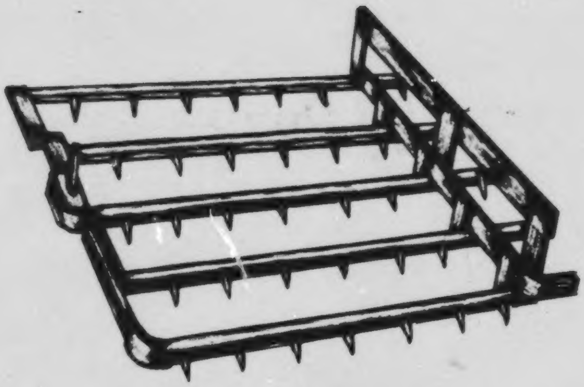
$$\text{Plant residue} \longrightarrow \text{Organic matter} \longrightarrow \text{Humus}$$

Humus is considered the storehouse for soil base elements (potassium, calcium, and magnesium). It holds base elements in sandy soils and it will hold four times more base elements than clay soil.

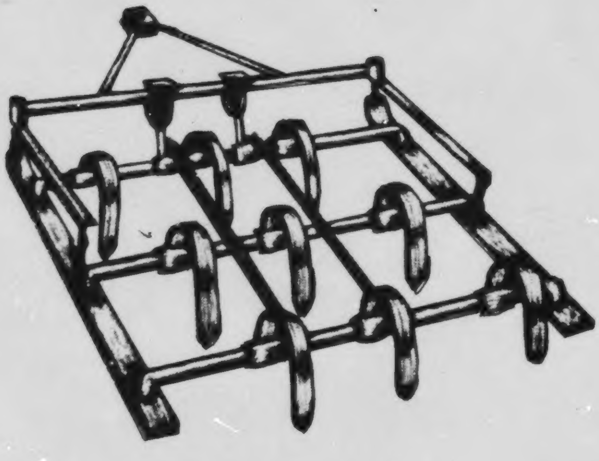
EQUIPMENT USED IN SEEDBED PREPARATION



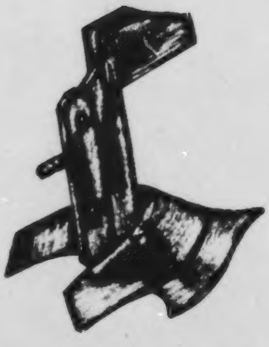
Disk Harrow



Spike-tooth Harrow



Spring Harrow



Middlebuster or Lister

UNIT: Land Preparation
TOPIC: Row Crop Seedbed Preparation
(Information Sheet continued)

Each of these pieces of equipment may be used in preparing a good seedbed.

Using a disk harrow before and after plowing with a disk or moldboard plow is considered a good practice in seedbed preparation.

If the land is disk harrowed before it is plowed, either with a disk or moldboard plow, good contact is made with the subsoil. Then, if the soil is disk harrowed after it is plowed, an ideal seedbed is provided.

Air spaces appear beneath the soil when it is plowed and then disked.

The plowed soil lacks proper contact with the subsoil and is not suitable for a seedbed if a disk is not used. Plowing is only one operation in seedbed preparation.

When a hardpan has developed beneath the layers of top and subsoil, a chisel is used to break the compact layer of soil. In some areas, chiseling is followed by disk harrowing and then moldboard plowing. The spike-tooth harrow is usually used to destroy weeds, aerate the soil, and make the top of all rows uniform before planting the crop.

The lister is used to prepare seedbeds for row crops. Soil is thrown both right and left, making a ridge about four inches higher than the surface. If the lister is not used to plow out the first ridge, only half of the soil is stirred. Double listing (passing over the soil the second time) is practiced in some row crop areas.

Lister-planter combinations are used to plant crops in rows. In some areas the lister rows are harrowed down before the lister-planter passes over the ridge.

Sometimes the disk harrow is used before the soil is listed. The depth of plowing, about four inches below and above the ridge, is not affected by disk harrowing.

Seedbeds are prepared by using a power tiller and bed shaper. This is a relatively new method and is often combined with the application of a pre-emerge herbicide.

Much can be said about preparing a seedbed, but there are three main characteristics that apply to a good seedbed. These characteristics are:

1. Soil particles are fine and pulverized, so the seed will be in good contact with the soil.

2. The seedbed should be firm enough to prevent drying, but yet loose enough for air circulation and seedling growth.

3. The soil surface should be free of old crop residue.

The most important factors in seedbed preparation are to prepare the best seedbed possible, the most economical way possible, and get the best "stand" or most seedlings out of the ground that is possible.

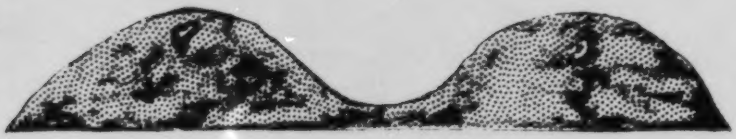
The method of preparing and time of preparing a seedbed will always depend upon the following factors:

1. Type of soil
2. Amount of rainfall
3. Amount of wind
4. Crop to be produced
5. Preceding crop
6. Insects that are present on previous crops
7. Diseases that were present on previous crops
8. Type of weed control practice

The three most commonly used methods of preparing row crop seedbeds are on top of furrow, in a furrow, and level with the surface.

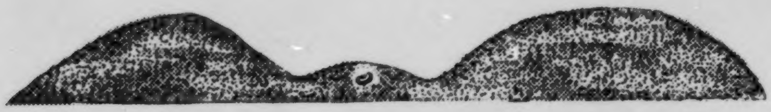
TYPES OF SEEDBEDS

Planting on a Furrow



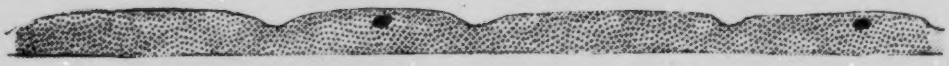
Used in areas of high rainfall.

Planting in a Furrow



For areas of low rainfall and high winds.

Planting on a Level



In areas of periodically hard rainfall but otherwise dry conditions.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Broadcast Crop Seedbed Preparation

OBJECTIVE: To become acquainted with methods and equipment used in seedbed preparation for broadcast crops.

REFERENCES:
Required:
1. Information Sheet, "Broadcast Crop Seedbed Preparation".

QUESTIONS OR ACTIVITIES:

1. What would be the proper physical condition of the soil that would allow penetration and conservation of rainfall?
2. Why is weed control important to the culture of small grain?
3. Why is wind and water erosion control important in small grain farming?
4. Why should there not be large amounts of undecomposed organic matter left in the area where the small grain seed is to be planted?
5. Why and how deep should small grains be planted?
6. Why is the lister or middlebreaker not used for broadcast seeding?
7. What is the disadvantage of using the moldboard plow for seedbed preparation?

Information Sheet
for
BROADCAST CROP SEEDBED PREPARATION

Most small grains are either broadcast or drilled in Texas. Preparation of a seedbed for these crops depends more on the soil structure, type, and area of production than any other factors. Proper seedbed preparation is essential for good yields of small grains. Important points to consider are:

1. Prepare soil to proper physical condition to allow penetration and conservation of rainfall.
2. Provide adequate drainage to allow for normal plant growth and to avoid puddling of the soil during grazing.
3. Control weeds.
4. Control erosion by wind and water.
5. Avoid leaving large amounts of undecomposed organic material in the seed zone at the time of planting.
6. Plant sufficiently deep to assure adequate moisture and survival until plants are well established.

With these six considerations in mind let's look at some of the specific ways seedbeds are prepared in parts of Texas and then generalize about some of the other parts of Texas.

High Plains-

The high plains is predominately a wheat producing area, but some oats and barley are also grown there. The land preparation is generally the same for all three small grains and is begun shortly after harvest which is normally in June. On dry land, the first thing that is done is to chisel the fields so that the subsoil will be opened up to catch and hold as much moisture as possible when the fall rains and winter snows come. The next step is to plow the land with a one-way plow, but this is delayed until shortly before planting time.

The one-way plow will leave a lot of stubble on top of the ground and will leave some clay on the surface, thus protecting the land from wind erosion. A fairly fine soil structure is left in the area where the seed is placed by the one-way. Then in September or October the grain is drilled in with a fairly deep drill furrow which tends to prevent wind erosion, and which will collect moisture from rain and snow.

In addition to this, about one time every four or five years the land is deep plowed with a moldboard type plow. This is done to roll some of the clay subsoil to the surface, reducing the wind erosion. In the sandy soils of the high plains the heavy clay has a tendency to work down in the soil, so after a period of time the deep plowing must be done again.

UNIT: Land Preparation
TOPIC: Broadcast Crop Seedbed Preparation
(Information Sheet continued)

Blackland and Grand Prairies-

The blackland and grand prairies cover the central part of Texas from the Red River to San Antonio and Southeast Texas from Grimes County to Bee County. In this area nearly all of the small grains grown are planted in dry land situations and the seedbed preparation is designed to conserve moisture.

Soon after harvesting the small grains, the land is plowed either with a disk-breaking plow or with a one-way. The breaking plow is used more in this area because the soil is normally tighter than the soil on the high plains.

The fields are then left until shortly before planting time, which is around October and November. At this time the fields are worked with a tandem disk, or a spike tooth harrow to break clods in the field. The tandem disk is used more often, however, because it will break most of the clods as well as leave a seedbed free of weeds.

After disking, the grain is drilled in with a drill that leaves a fairly shallow row.

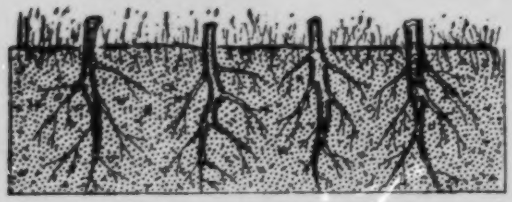
These areas of Texas are the primary producers of small grains, and the cultivation practices are mainly concerned with conserving moisture and planting in clean fields. The high plains farmer must also be interested in controlling wind erosion. Practices mentioned here may vary some in the areas described.

In order to get the best possible yield of small grains, consider the six things that were mentioned at the beginning of this information sheet and think about how they would apply to the local situation.

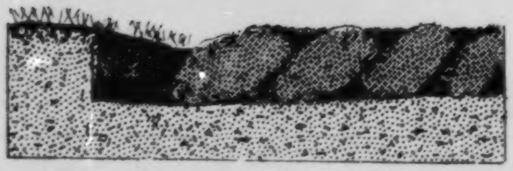
This has been devoted entirely to small grains because they are the predominant crops that are broadcast planted in Texas. However, some of the small seeded legumes and grass crops are planted with a drill, and if they are to be planted in this way the land preparation would be approximately the same with the same consideration applicable to those crops.

Moldboard plows are used to prepare seedbeds if the soil is not left bare for a long period of time.

SEEDBED PREPARATION

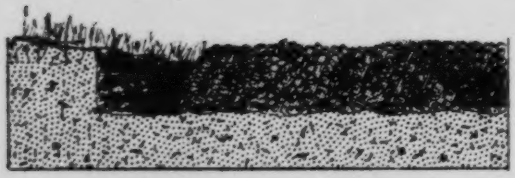


STUBBLE LAND READY FOR PLOWING



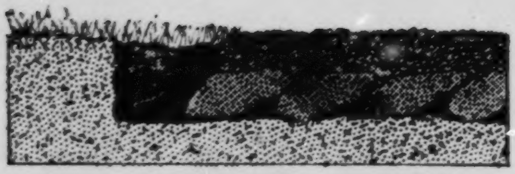
GOOD SUBSOIL CONTACT

LAND DISKED AND THEN PLOWED



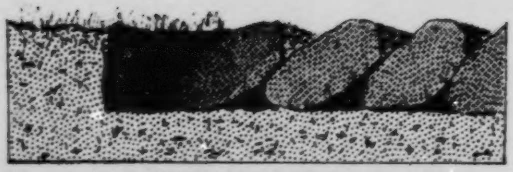
GOOD SEEDBED

LAND DISKED BEFORE AND AFTER PLOWING



LACKS SUBSOIL CONTACT

LAND DISKED AFTER PLOWING



POOR SEEDBED

LAND PLOWED BUT NOT DISKED

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Permanent Pasture Preparation

OBJECTIVE: To lead the student in understanding steps in the establishment of permanent pastures and the importance of land preparation.

REFERENCES:

Required:

1. Improving Permanent Pastures, VAS 4014, Illinois, pp. 1-4.
2. Information Sheet, "Land Preparation for Permanent Pastures".

QUESTIONS OR ACTIVITIES:

1. Why do pasture plants need land preparation?
2. What are some special needs of certain grass plants?
3. What are some of the factors that should be considered before planting an improved pasture?
4. What are some of the important factors in determining the amount of land preparation needed to start an improved pasture?
5. List the important points to consider in establishing a permanent pasture.
6. Give the necessary steps that are used in preparing a permanent pasture seedbed.

Information Sheet
for
LAND PREPARATION FOR PERMANENT PASTURES

Land preparation for any crop is a major undertaking and is even more important for permanent type pastures, and possibly more difficult. Any consideration given to land preparation would depend upon the kind of grass to be planted, location, including soil type, other vegetation, and climate, and amount of water available. However, in order to provide a root development media, the land must be prepared properly.

This is mentioned early because at one time many people believed that only seeded grasses would work in a pasture and all that was needed was to sow the seeds. Today with the development of the giant bermuda grasses, such as coastal, this belief has been changed. However, many people believe that before a grass can be sprigged the land must be cleaned of brush and weeds, levelled, etc., but this is not true. Many good stands of sprigged grasses have been established in areas where native pastures have pretty well been used up, and about the only land preparation that has been done was to dig a hole, set the sprig in it, cover it and spray with a herbicide to control the weeds. Everyday more is being learned about the establishment of permanent pastures and the necessary land preparations. With this background land preparation will be described based upon the type of grass to be planted or sprigged, the general area to be planted or sprigged, and the availability of water.

First,many permanent pasture grasses can be established from seed; the most common one is bermuda grass, but there are many more. For these grasses a good seedbed is desirable. In other words it takes about as good a seedbed for these grasses as it does for most of the row crops. Many of them are planted in rows, such as "Wintergreen Harding Grass", and "Klein Grass", and considerable land preparation would be necessary. Sprigged grasses do not require as good a seedbed for ideal growing, but it would be recommended. The main difference is that bedding would not be required and trees would not have to be removed. Tree removal aids growth because the bermuda grasses do not grow well where there is very much shade.

If native pastures are to be planted or sprigged, without irrigation, it would be advantageous to remove as much of the vegetation as is possible, especially weeds and underbrush, prior to setting or planting the grass. This conserves as much moisture as possible. Again, the ground should be clean, all vegetation removed and the ground worked. This is not always possible, so the next best thing is to plant according to the needs of the land. The land should be allowed to settle before planting. It is best to disk lightly before sowing seed. This practice will put the seed in contact with soil moisture.

UNIT: Land Preparation
TOPIC: Land Preparation for Permanent Pastures
(Information Sheet continued)

Some grass plants may require special care until they become established. For example, after coastal bermuda is sprigged, it may be advisable not to disturb the residue from other grasses or crops so that the young grass is protected from wind and heavy rains.

If the sprigged or planted grass is to be irrigated, the land should be cleaned and leveled. The reason for the leveling is to allow irrigation by gravity and eliminate the necessity for irrigation systems. If the leveling will cost more than the sprinkler system, then in most cases it will be more economical to use the sprinkler system, but in some instances sprinklers will not work. Watering during the summer on hot days will result in considerable losses of water. In these cases, more water will be lost to evaporation than from flood irrigations.

If the pasture is to be irrigated, all weeds, grasses, and trees should be removed, mainly for ease of watering. A denser stand will be formed more quickly if the land is cleared and well prepared.

To sum up what has been said, a person can generally study their own situation and the need for grass and then locate the grass that is most adaptable to the particular situation. Determine what land preparation is necessary for the grass selected to get the best stand as quickly as possible. Each of these four things mentioned will require a lot of studying on the part of the farmer in order to develop a good sound plan that will eventually develop into an improved or partially improved pasture. The following factors are very important when preparing to establish an improved pasture: cost of diverting the land to pasture, type of grass to plant, local growing conditions, land preparation needed, and the time of year to seed or sprig the land. Other factors are:

Topography of the land
The amount of rainfall expected
Type of vegetation already growing
Soil type, texture, and structure
Possibility of irrigating land
How the improved pasture is to be used

These factors are explained in detail below:

> Topography of the land includes the lay of the land, is it flat or hilly, is it washed out or smooth, or any number of conditions that exist in Texas. The amount of rainfall expected would determine how much clearing that would be necessary. If there is a shortage of moisture, extensive weed and brush con-

UNIT: Land Preparation
TOPIC: Land Preparation for Permanent Pastures
(Information Sheet continued)

trol should be carried out, but if there is plenty of moisture available, only a minimum amount of brush control would be necessary. In nearly all cases, a sound weed control program should be practiced.

The type of vegetation growing in an area would also affect the amount of land preparation necessary. For example, some plants produce a poison in their roots that will keep other plants from growing around them. Some plants, including many trees, have roots that are very close to the top of the ground and these plants will use the available moisture in the top 12 inches of the soil very rapidly. There are many other plants that will not compete favorably with the grass to be established. Whenever these situations exist, all plants that will not compete favorably with the grass should be eliminated. Always keep in mind that grazing cattle or livestock need some shade, and many trees will compete favorably with established grasses.

The type of soil also will affect the amount of land preparation needed. If there is very little topsoil, it would be difficult to plow the entire area, but if the soil is deep, it would probably be beneficial to plow the entire area. On the other hand plowing a loose, sandy loam may be an unnecessary expense, but a tight clay soil would require plowing in order to loosen the soil so the grass roots could penetrate. Again it is difficult to say how much land preparation is necessary because all sorts of situations exist between the two extremes mentioned.

If the land is to be irrigated, what type of irrigation is to be used? Flooding may be cheapest. In this case, the land will have to be leveled and cleared completely. If sprinklers are to be used, the land wouldn't necessarily have to be leveled but it should still be cleared. The main things to consider are the opposing costs of the different types of irrigation systems and the evaporation rate of the locality.

Another point to consider is the expected use of the grass after it is established. This is more an academic consideration but if there is a possibility of baling the grass, the entire area should be more or less accessible. This would involve clearing brush and filling in rough places such as washes. In particular situations this may be desirable anyway.

Go back and read question four again. There is no easy answer to this question because there will never be an instance where any of the factors mentioned, except maybe the last one, will not depend on some of the others, and they will all depend on the climate. So to actually determine the amount of land preparation needed, the best balance of conditions that will yield the most desirable situation

UNIT: Land Preparation
TOPIC: Land Preparation for Permanent Pastures
(Information Sheet continued)

for a farmer in his locality should be determined and then followed.

The main thing to remember is that shortcuts in preparing a permanent pasture may result in cutting short the grass available and will probably cost the farmer extra rather than make him money. Shortcuts will limit both quantity and quality of hay produced.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Land Management Practices (Leveling of Land, Drainage, and Erosion)

OBJECTIVE: To acquaint the student with land management practices.

REFERENCES:

Required:

1. Our Land and Its Care, The Fertilizer Institute, pp. 18 and 29-38.
2. Our Soils and Their Management, Donahue, pp. 391-424.
3. Information Sheet, "Land Leveling".

QUESTIONS AND ACTIVITIES:

1. How does drainage affect the soil?
2. Why is 20 to 30 percent of the irrigated land in arid regions drained?
3. What are the main purposes of drainage?
4. In what type of climatic region is drainage most important?
5. List the benefits of good drainage.
6. What is the cause of excess water in soils?
7. What are some methods of drainage? Explain.
8. How is the water table lowered?
9. What are the best methods of controlling erosion on crop land?
10. What are the management water practices involved in a good cropping system? Explain by giving water needs of corn, cotton, sorghum, rice, and wheat.

Information Sheet
on
LAND LEVELING

One of the main purposes of land leveling is to prepare land for irrigation and/or water control. When land is properly graded, the sloughs and hollows are eliminated, thus causing the water to flow more evenly down the rows or within areas that are bordered by levees. If the field is properly graded, it can be maintained by annual land leveling or floating before seeding a crop.

The advantages of leveling land for cultivation of crops are as follows:

1. Land leveling aids the farmer in controlling the water movement and depth of percolation in the soil. Also, the water spreads more uniformly if the land is level.
2. Irrigation levees can be straight and perpendicular on rice lands.
3. Properly leveled land drains more quickly before the planting season permitting the crop to be planted earlier.
4. Level land is easier cultivated than land with many ridges and sloughs.
5. Harvest machinery operates more efficiently on level land than on land that contains hollows, rocks, or ridges.
6. Land leveling increases the uniformity of contours between levees on rice land.
7. Weeds are easier to control on rice land where a uniform depth of water can be maintained.

The implements used to level land are scrapers and soil movers. The carry-all scraper and the land plane are the pieces of equipment most commonly used to level land. Before the land is leveled, it should be plowed and harrowed. After the land is properly leveled, it is important that it be carefully plowed again. Water cannot be forced over high ridges, but it will seek the low places in a field. Rows of uneven heights may cause the water to cross rows, which results in uniform wetting of the land.

Land is usually leveled during the spring or just before the planting season. Soil should contain enough moisture to prevent its being moved by the normal wind movement; yet, it must be dry enough to spread evenly to free it of clods.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Introduction

OBJECTIVE: To acquaint the student with the history of the fertilizer industry and the use of fertilizer.

REFERENCES:

Required:

1. Using Commercial Fertilizers, McVickar, pp. 7-16
2. The Fertilizer Handbook, The Fertilizer Institute, pp. 1-9 and 16-19.
3. Our Land and Its Care, The Fertilizer Institute, pp. 68.
4. Information Sheet, "Introduction to Fertilizers".

QUESTIONS OR ACTIVITIES:

1. When did the chemical fertilizer industry have its beginning?
2. When was fertilizer first made in the United States?
3. Where were commercial fertilizers first made in the United States?
4. Approximately how many tons of fertilizer were used by the nation's farmers in 1977?
5. Where and when was the first commercial mining of phosphate rock in the United States?
6. Fertilizers were composed of what products in the early days of the industry?
7. What part of the United States uses the greatest amount of fertilizers?
8. Who is considered the father of the agricultural lime industry?
9. What scientist made the following statement over a century ago? "We should return to the soil the plant food which is removed by crops".
10. How important are fertilizers in the field of crop production?
11. What type of fertilizer was produced first in the United States?
12. Why do we have state fertilizer laws?

Information Sheet
on
INTRODUCTION TO FERTILIZERS

More than a century ago, the statement was made by a German scientist, Justus Von Liebig, that we should return to the soil the plant food which is removed by crops. Naturally, such reasoning was centered around the type of farming that was practiced 100 years ago. Liebig showed that certain plant nutrients, such as nitrogen, phosphorus, and potassium, were used to increase plant growth. As early as 1849, superphosphate was being produced from bones and sulphuric acid and sold as a commercial fertilizer.

Adding plant nutrients to the soil to increase plant growth is not a recent discovery. The ancient Greeks, Romans, and Chinese used fertility practices to improve plant production. Animal manure, fish, bone, marl (silt, sand, or clay containing calcium carbonate), chalk (a limestone), ashes, and guano (term usually used to identify bat and waterfowl manure) were the first fertilizers used by man. When the early settlers arrived on the North American continent, they found the Indian using fish to fertilize his corn. Corn yields were increased by placing a fish beneath each hill of corn.

In 1849, superphosphate was produced at Baltimore, Maryland. Today superphosphate is one of the leading products in the fertilizer industry. Millions of tons of phosphate rocks are taken from deposits in Tennessee, Florida, North Carolina, and western fields. From this early beginning, manufacture of fertilizers has expanded to cover many other nutrients. Thus, today the production of commercial fertilizers has reached a tremendously high level of production.

1. State Fertilizer Laws

   a. State fertilizer laws protect not only the consumer, but also manufacturers who are conducting their businesses in an honest way. These laws are enacted to eliminate the production and sale of fertilizers which do not meet the standards established by the Feed and Fertilizer Control Service.

   b. A fertilizer registration request must include:

      (1) The name and address of the commercial fertilizer distributor
      (2) A guaranteed analysis of plant nutrients. For example, the total nitrogen (N), phosphorus (P_2O_5) and potash (K_2O) must be listed
      (3) The fertilizer brand name

UNIT: Fertilizers
TOPIC: Introduction
(Information Sheet continued)

(4) Sources from which the nutrients are derived
(5) Copies of all printed material pertaining to the sale and distribution of the commercial fertilizer

c. The Feed and Fertilizer Control Service charges a 25¢ fee per ton or a minimum fee of $25.00 per year as an inspection cost to the distributor.

2. Additional Plant Food Elements, Besides Nitrogen, Phosphorus, and Potassium

a. When claims are made for plant nutrient elements other than N-P-K, a guarantee must be made in terms of available elements.

b. An element is considered "available" if the form in which it is added to the product has been shown to give plant responses or if the element can be dissolved in water or in some other solvent which is recognized to indicate availability to plants.

c. When 0.03% or more of water soluble boron is present, the following must be made part of the label. "WARNING" in letters at least one-half inch in height; it shall state the crops for which the fertilizer is to be used and it shall state that use of the fertilizer on any other crops under conditions other than those recommended may result in serious injury to the crop.

3. Analysis of Fertilizers

a. An individual who buys fertilizer for private use may take a sample of the fertilizer in the presence of the dealer or his representative and send the sample to the Feed and Fertilizer Control Service in College Station for analysis. Neither the results of the analysis nor the name of the manufacturer may be published. The purchaser sending the sample must pay for the analysis service. Two general rules for submission of samples are as follows: Each sample must be placed in a container that shows the name of the person submitting the sample. A certificate signed by the purchaser and seller or two disinterested witnesses must accompany the sample.

UNIT: Fertilizers
TOPIC: Introduction
(Information Sheet continued)

b. Instructions for sampling are supplied by the Director of the Feed and Fertilizer Control Service, College Station, Texas.

c. When 0.001% or more of molybdenum is present, the label must bear the following: "CAUTION. This fertilizer is to be used only on soils which respond to molybdenum. Crops high in molybdenum are toxic to ruminants."

4. Degrees of Fineness of Unacidulated Phosphatic Materials and Basic Slag

   a. The fineness of unacidulated phosphatic materials shall be stated in terms of the percentage that will pass U.S. Standard Sieve Series No. 200 (200 mesh, dry sieve method).

   b. Basic Slag - U.S. Standard Sieve No. 100

5. Organic Base Fertilizer

   The term "organic" or "organic base" may be used as part of the label of commercial fertilizers only if the product contains at least 25% by weight of natural organic materials and/or 10% by weight of the total nitrogen supplied by an organic material. The name and percentage of the material must be clearly and prominently printed on the label.

6. Additives in Fertilizer

   a. When a pesticide or any other additive, other than plant nutrients, is incorporated in a commercial fertilizer, the product must be registered and guaranteed to show the kind and percentage of each additive as well as the claimed plant nutrient elements.

   b. The purpose for which the combined fertilizer and additives are recommended shall be stated prominently on the label, in addition to other required information.

Presently, commercial fertilizers are distributed in 50-pound bags or delivered in bulk form. The language of the trade is to deliver according to the grade or

UNIT: Fertilizers
TOPIC: Introduction
(Information Sheet continued)

analysis of a fertilizer mixture. The analysis shows the three major units of fertilizer elements. The first number represents nitrogen content; second, the **phosphorus** content; and third, the potash content.

The three numbers give the guaranteed analysis of the three primary plant nutrients. These are expressed in percentage, by weight. The ratio by which these are mixed determines the grade ratio. An understanding of these grade ratios will help in making the decisions as to which fertilizers will give best results.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Plant Nutrients and Their Functions

OBJECTIVE: To acquaint the student with the various nutrients and their functions.

REFERENCES:

Required:

1. Information Sheet, "Plant Nutrients and Their Functions"
2. The Fertilizer Handbook, The Fertilizer Institute, pp. 16-19, 47-56, 71-84, and 117-118.
3. Using Commercial Fertilizers, McVickar, pp. 17-36.

QUESTIONS OR ACTIVITIES:

1. What are the more prominent plant nutrients?
2. What three major nutrients are identified by the analysis on the fertilizer bag?
3. An application of nitrogen to a corn crop will cause it to react in what way?
4. A deficiency of phosphorus in the growing corn plant will cause what reaction?
5. If there is a shortage of potash, the corn plant will react in what way?
6. An increase in plumpness of grain can be a result of an ample supply of what plant nutrient?
7. Application of limestone to the soil will add what plant nutrient to the soil?
8. How are magnesium and sulphur classified as plant nutrients?
9. What are trace-element plant foods?

Information Sheet
on
PLANT NUTRIENTS AND THEIR FUNCTIONS

At least 16 elements are considered necessary for the growth of green plants. If the student of crop farming is going to become skilled in the production of crops, he must become acquainted with the elements necessary for plant growth.

Each nutrient has a certain function in plant growth and its fruit production. The more prominent plant food nutrients and their functions are:

Nitrogen - Vegetative growth depends upon nitrogen as a plant food. It must be applied, available in the soil, or furnished by leguminous plants. Nitrogen is readily available to crops, but it is also easily exhausted through soil erosion and leaching. Other effects of nitrogen on plant life are:

1. Makes the plant grow fast and gives it a dark green color
2. Increases the quantity and quality of the plant leaf and adds to fruit and seed yield
3. Increases the protein content in plants
4. Serves as a food for microorganisms while they decompose organic materials

Phosphorus - Plants must have phosphorus in order to develop healthy roots and good seed and reach maturity early. Plants that receive adequate phosphorus get off to a good start early. However, young plants receiving inadequate phosphorus, the leaves will be a reddish-purple. Usually a very small amount is available as a plant nutrient in one growing season. Other effects of phosphorus on plant life are:

1. Stimulates early root formation and growth
2. Brings about early maturity
3. Helps bring about blooming and seed formation
4. Gives plants (fall-seeded grains) more winter hardiness

Potash - This plant nutrient helps make strong stalks and helps form a good root system. A shortage of potash may cause the leaves to fire or dry along the edges and tips. Other effects of potash to plant life are:

1. Makes plant resistant to diseases and reduces lodging
2. Increases fullness of grain or seed
3. Aids in the transfer of starches, sugars, and oils
4. Gives winter hardiness to the plant

Calcium as a secondary plant nutrient - Calcium is used in large quantities in some areas due to it being an active ingredient of lime. Soil with a high acidity (pH) content requires the application of lime. Other effects of calcium on plant life are:

1. It is essential for root growth, plant vigor and stem stiffness.
2. It neutralizes poisons produced in the plant.

UNIT: Fertilizers
TOPIC: Plant Nutrients and Their Functions
(Information Sheet continued)

3. It is essential to grain and seed formation.
4. It adds calcium to food and feed crops.

Magnesium as a secondary plant nutrient - This plant nutrient helps correct the soil acidity and is an essential part of the plant chlorophyll. Other effects of magnesium on plant life are:

1. It aids in giving a green color to the plant.
2. It is essential for the formation of sugar in the photosynthesis process.
3. It serves as a carrier of phosphorus in the plant.

Sulphur as a secondary plant nutrient - Plants may use as much sulphur as they do other secondary nutrients, including phosphorus, a primary nutrient. It is considered important in protein building in the plant. Other effects of sulphur on plant life are:

1. It is essential in chlorophyll formation and it helps the plant maintain a dark green color.
2. It increases root growth and nodule formation in legumes.
3. It is essential to seed production and the general vigor of plant growth.

Micro plant nutrients - The micro plant nutrients are known as the trace-element plant foods. Micro nutrients are not found in all fertilizers, even though they are important for plant growth. The trace-element plant foods are: Boron, iron, copper, managanese, zinc, chlorine, and molybdenum. The effects of the trace-elements on plants are:

1. Boron improves quality in crops and seeds of leguminous plants.
2. Iron is important in the production of green matter in plants.
3. Copper is important in seed setting.
4. Manganese increases the availability of phosphorus, calcium, and magnesium, and aids in plant food manufacturing.
5. Zinc is essential to plant growth.
6. Chlorine is seldom deficient in field crop production, but it is essential to plant growth.
7. Molybdenum is used by legumes in nitrogen fixation. It is also important to the production of certain vegetables.

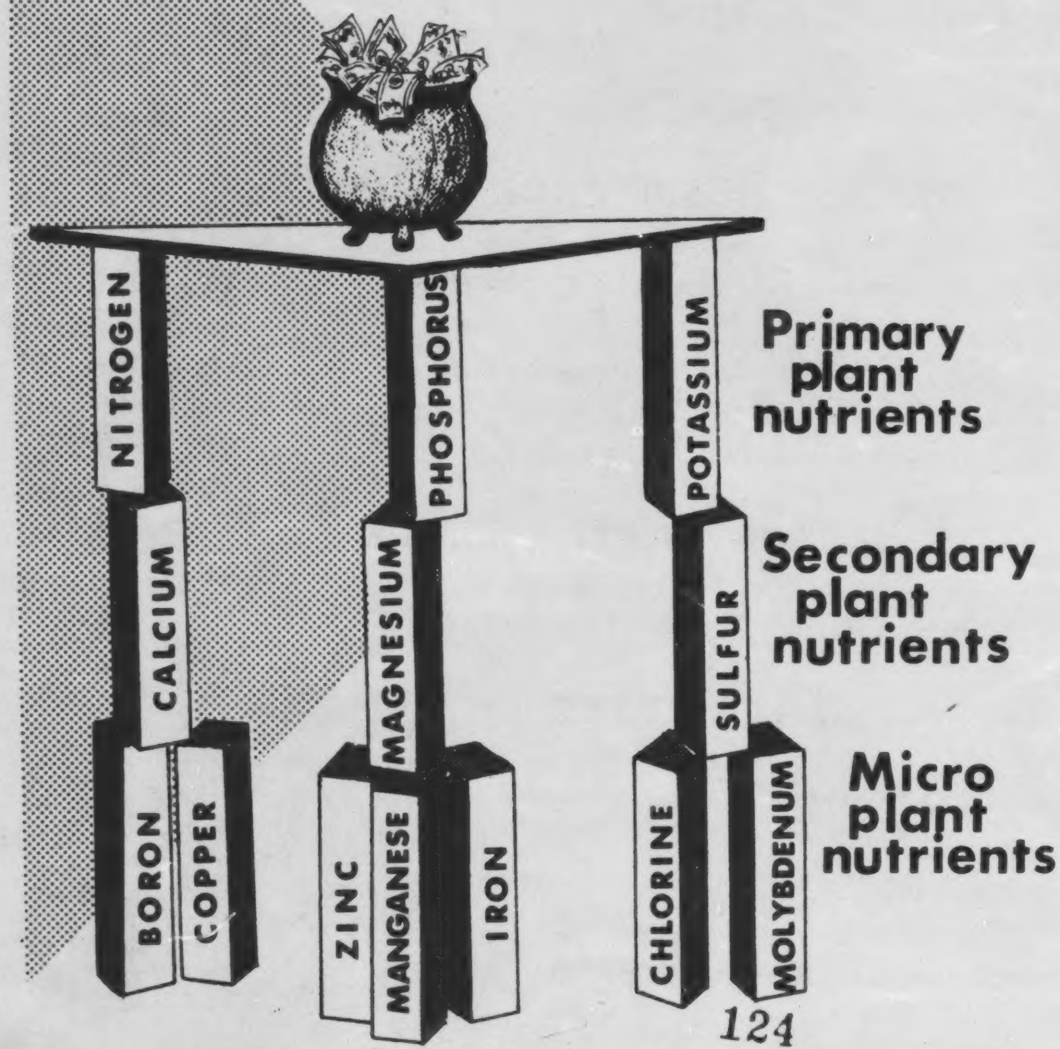
The three nutrients identified by the analysis on a fertilizer bag are nitrogen, phosphorus, and potash.

FUNCTIONS OF MAJOR PLANT NUTRIENTS

	N	P	K	Ca	Mg	S
Makes more and greener LEAVES	★		★			☆
Stimulates ROOT growth		★		☆		
Promotes STEM growth			★	☆		
Aids BLOOMING, FRUITING and SEED vigor	★	★	★	☆		☆
Promotes rapid GROWTH	★	★				
Gives winter HARDINESS		★				
Promotes DISEASE RESISTANCE and VIGOR			★	☆		☆
Important in CHLOROPHYLL synthesis	★				☆	☆
Important in FAT and OIL production			★		☆	
Important in PROTEIN synthesis	★		★			☆
Important in CARBOHYDRATE synthesis			★		☆	
Aids TRANSLOCATION of plant food			★		☆	
Regulates NUTRIENT UPTAKE					☆	
Changes SOIL pH				☆	☆	☆
Neutralizes POISONS				☆		
Feeds soil MICROORGANISMS	★					☆

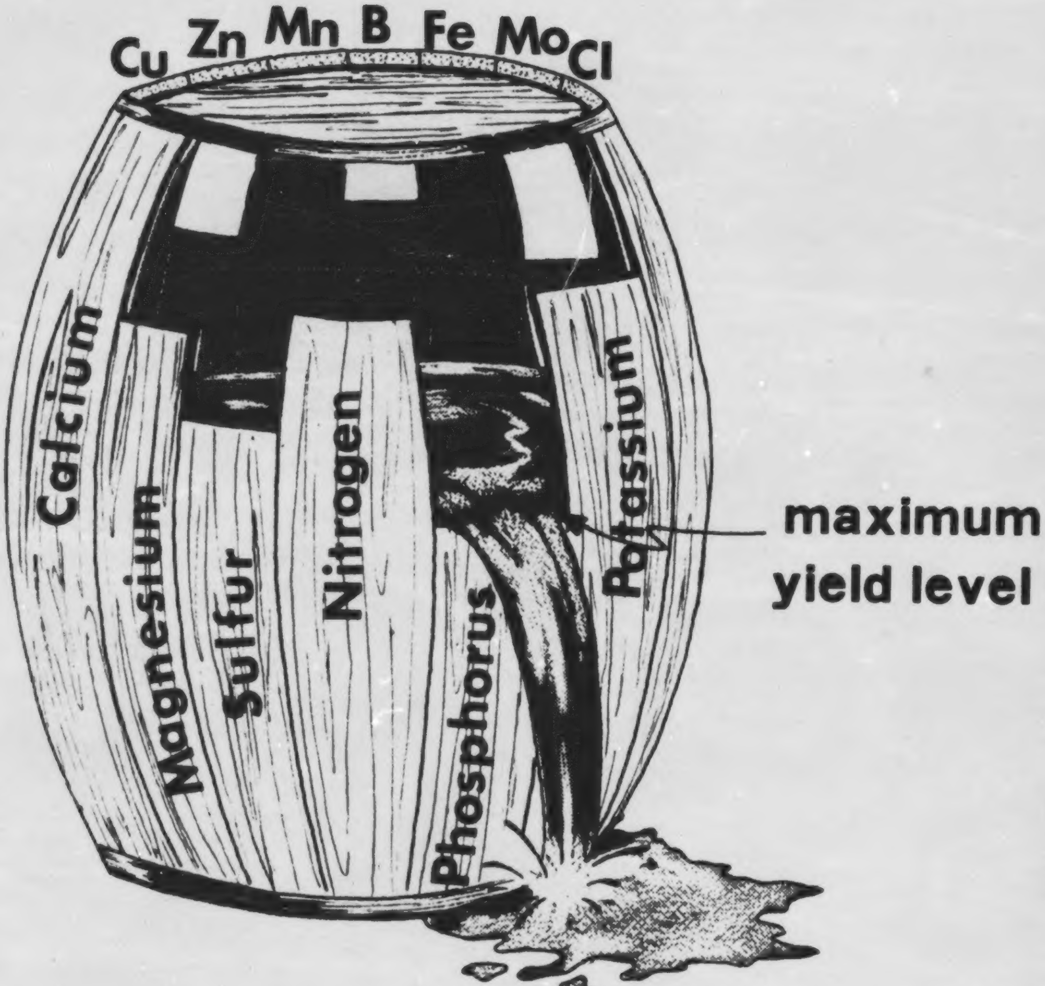
★ PRIMARY PLANT NUTRIENTS
☆ SECONDARY PLANT NUTRIENTS

Profits Can Fall If Any Nutrient Is Short!


NITROGEN
PHOSPHORUS
POTASSIUM
Primary plant nutrients
CALCIUM
MAGNESIUM
SULFUR
Secondary plant nutrients
BORON
COPPER
ZINC
MANGANESE
IRON
CHLORINE
MOLYBDENUM
Micro plant nutrients

THE IMPORTANCE OF A BALANCED PLANT FOOD PROGRAM:

PLANT YIELD CAN ONLY GO AS HIGH AS THE MOST DEFICIENT NUTRIENT


Cu
Zn
Mn
B
Fe
Mo
Cl
Calcium
Magnesium
Sulfur
Nitrogen
Phosphorus
Potassium
maximum yield level

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Types of Fertilizers (Advantages and Disadvantages)

OBJECTIVE: To have the student become familiar with the various types of fertilizers.

REFERENCES:

Required:
1. Information Sheet, "Types of Fertilizers".
2. The Fertilizer Handbook, pp. 45, 47-51, 53, and 85.
3. Using Commercial Fertilizers, pp. 103-123, 125-133, 245-252, and 306.

QUESTIONS OR ACTIVITIES:

1. In what three forms are commercial fertilizer used?
2. What is the major source of hydrogen for ammonia production?
3. What are the advantages of crop residue practices in a soil improvement program?
4. What are some of the advantages of a green manure crop?
5. What is a complete fertilizer?
6. What is the meaning of ammoniation of fertilizer mixtures?
7. How many pounds of nitrogen, phosphoric acid, and potash are in one ton of 13-13-13?
8. Why is it important to use fertilizers in fish ponds?

Information Sheet
on
TYPES OF FERTILIZERS

Adding plant nutrients to the soil to increase plant growth is not a recent practice. The ancient Greeks, Romans, and Chinese used fertility practices to improve plant production. Animal manure, fish, bone, marl (silt, sand, or clay containing calcium carbonate), chalk (a limestone), ashes, and guano (term usually used to identify bat and waterfowl manure) were the first fertilizers used by man. When the early settlers arrived on the North American continent, they found the Indians using fish to fertilize their crops. Corn yields were increased by placing a fish beneath each hill of corn.

The major purpose of fertilizing soil is to enrich it, thus making it more productive. Most soils do not contain adequate quantities of plant food; therefore, it is necessary to add fertilizers to help eliminate plant food deficiencies. Fertilizer applied to the soil also aids in making farming a more profitable business.

The major types of fertilizers used by the farmer are:

1. Ammonium nitrate, a solid nitrogen fertilizer, that is 33.5 percent nitrogen and completely soluble in water
2. Ammonium sulphate, a solid nitrogen fertilizer, which contains 21 percent nitrogen and is soluble in water
3. Urea, a solid organic nitrogen compound, which contains 45 percent nitrogen
4. Sodium nitrate, calcium nitrate, and calcium cyanamide, solid nitrogen fertilizers, that contain 16, 17, and 21 percent nitrogen respectively
5. Anhydrous ammonia, a gaseous nitrogen fertilizer, containing 82 percent nitrogen
6. Superphosphate, a rock phosphate treated with sulphuric acid, contains about 20 percent phosphorus
7. Triple superphosphate, a rock phosphate treated with sulphuric acid, contains about 45 percent phosphorus
8. Liquid phosphoric acid, a liquid fertilizer, contains about 52 percent phosphorus. It may be applied with anhydrous ammonia
9. Ammonium phosphates, a reaction of anhydrous ammonia and phosphoric or sulphuric acid, forms ammonium phosphates, such as 16-20-0 and 21-53-0

Potassium fertilizers are potassium chloride and potassium sulphate which contains about 50 percent potassium.

Mixed fertilizers usually contain three plant nutrients. For example, 1:1:1 (8-8-8) nutrient ratio. It contains 8 percent nitrogen, 8 percent phosphorus and 8 percent potassium.

UNIT: Fertilizers
TOPIC: Types of Fertilizers
(Information Sheet continued)

Calcium is in the form of limestone, gypsum, burned lime, and oystershell to the seedbed.

Magnesium is in the form of dolomitic limestone. Another source of supply is Epsom salts. (Magnesium sulphate).

Sulphur is in the form of elemental sulphur, ammonium sulphate, superphosphate, or gypsum. (Calcium sulphate).

Trace elements such as copper, zinc, and manganese may be applied to seedbed soils in sulphate form. For example, copper is supplied as copper sulphate. Other trace elements, boron and iron, are supplied in the form of borax and iron oxide.

Crop residue improvement practices help to increase the quality and quantity of a crop. Residue properly managed builds up the organic matter in the soil, reduces soil and water losses, and influences the chemical properties of the soil by making them more available to the plants.

Green manure crops are usually grown to add nutrients to the soil. They also add organic matter to the soil. Other advantages of using green manure crops are: they improve the physical condition of the soil, conserve nutrients by reducing leaching, and add a high quality nitrogen to the soil. Green manure crops should be fertilized in order to produce more organic matter. More nitrogen is added to the soil if legumes are used as green manure crops.

TYPES OF FERTILIZERS
~COMMERCIAL~

ADVANTAGES		DISADVANTAGES
1. SOLUBLE	LIQUID	1. REQUIRES COSTLY EQUIPMENT
2. FAST AVAILABILITY		2. WILL BE LOST IF APPLIED TO BARE SOIL
3. CAN BE APPLIED IN IRRIGATION WATER		3. LIMITED IN TYPE AND AMOUNT OF NUTRIENTS
4. CAN BE APPLIED AS FOLIAR SPRAY		4. LOOSES EFFECTIVENESS QUICKLY
1. REMAINS INACTIVE UNTIL MOISTURE IS AVAILABLE	SOLID	1. NOT AS READILY AVAILABLE AS GAS AND LIQUID
2. WIDER RANGE OF TYPES AND AMOUNTS OF NUTRIENTS		2. SOME TYPES NOT QUICKLY SOLUBLE
3. CAN BE APPLIED IN MANY VARIOUS WAYS		3. USUALLY LOWER CONCENTRATION THAN GAS OR LIQUID
4. MORE ADAPTABLE TO ALL KINDS OF PLANTS		4. HAS TO HAVE MOISTURE BEFORE IT'S AVAILABLE
1. WIDER AREA OF COVERAGE IN THE SOIL	GASEOUS	1. CAN BE APPLIED BENEATH THE SOIL ONLY
2. COMES IN HIGHER CONCENTRATIONS		2. DANGEROUS TO STORE
3. READILY AVAILABLE		3. EQUIPMENT COSTLY
4. GIVES FASTER START TO PLANTS		4. MUST BE APPLIED JUST BEFORE PLANTING OR WILL BE LOST

TYPES OF FERTILIZER

~NATURAL~

ADVANTAGES	DISADVANTAGES
MANURE	
1. MAKES MORE PLIABLE SOIL	1. SLOW DECOMPOSITION
2. FURNISHES ORGANIC MATTER FOR BACTERIA	2. MAY BE DEFICIENT IN PHOSPHORIC ACID
3. ACTS AS WATER HOLDING AGENT	3. NOT ABLE TO BE STORED
4. CONTAINS MORE TRACE ELEMENTS THAN COMMERCIAL FERTILIZERS	4. INVOLVES HIGH LABOR COSTS
	5. SPREADS WEED SEED
CROP RESIDUE	
1. INCREASE ORGANIC MATTER	1. MAINLY CELLULOSE
2. HELPS MAINTAIN MOISTURE	2. SLOW TO DECOMPOSE
3. AIDS MICROORGANISMS IN GROWTH	3. LACKS CERTAIN NUTRIENTS
4. AIDS AIR CIRCULATION AND HELPS MAINTAIN CROP TEMPERATURE	4. DOES NOT PRODUCE A STOREHOUSE FOR ELEMENTS QUICKLY
GREEN MANURE	
1. DECOMPOSES MORE READILY THAN CROP RESIDUE	1. MAY BE TAKING THE PLACE OF A COMMERCIAL CROP
2. MAKES HUMUS QUICKER THAN CROP RESIDUE	2. LACKS CERTAIN NUTRIENTS
3. SLOWS PERCOLATION	3. NOT AS HIGH A RETURN AS FROM COMMERCIAL FERTILIZERS
4. AIDS MICROORGANISM ABUNDANCE	4. MAY REQUIRE COMMERCIAL FERTILIZERS TO GROW IT

PLANT NUTRIENTS IN FERTILIZER MATERIALS

Materials	Nitrogen N%	Phosphorus P_2O_5%	Potassium K_2O%	Calcium %	Magnesium %	Sulphur %
Ammonium Nitrate	33.5	--	--	--	--	--
Ammonium Sulphate	21	--	--	--	0.3	23.7
Urea	45	--	--	1.5	0.7	.02
Sodium Nitrate	16	--	0.2	0.1	.05	.07
Calcium Nitrate	15	--	--	19.4	1.5	.02
Calcium Cyanamide	21	--	--	38.5	.06	0.3
Anhydrous Ammonia	82	--	--	--	--	--
Superphosphate	--	20	0.2	20.4	0.2	11.9
Liquid Phosphoric Acid	--	58	--	--	--	--
Ammonium Phosphate	11	48	0.2	1.1	0.3	2.2
Potassium Chloride	--	--	62	--	0.1	0.1
Potassium Sulphate	--	--	53	0.5	0.7	17.6

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Applying Fertilizers

OBJECTIVE: To acquaint the student with the various methods of applying fertilizers, time to apply, and types of equipment used to make application.

REFERENCES:

Required:

1. Information Sheet, "Applying Fertilizers".
2. Farm Machinery and Equipment, Smith, pp. 269-275, and 281-287.
3. The Fertilizer Handbook, pp. 16-19, 83-84, and 100-101.
4. Using Commercial Fertilizers, McVickar, pp. 181-183, 205-213.

QUESTIONS OR ACTIVITIES:

1. How can one get the maximum returns from an application of fertilizer?
2. What are some of the methods of applying fertilizers?
3. Why is it important to apply fertilizer materials at the proper time?
4. Why is it important to know the types of fertilizer application equipment?
5. List the factors that influence the methods of applying fertilizer.
6. What type of equipment is used to distribute dry fertilizer?
7. List the three fertilizers that can be applied in solution.
8. What are the two methods used to apply fertilizer for plant use? Give location of fertilizer to plant.

Information Sheet
on
APPLYING FERTILIZERS

Today there are many types and forms of fertilizer being used to improve quality and quantity of crops. Each crop has its specific fertilizer needs, and the operator must use the material that will yield the maximum return. Crops respond differently to fertilizer applications and the type of soil on which they are growing.

Specific fertilizer materials are being distributed today as bulk dry, liquid, gaseous, and barnyard forms. Methods of applying these materials are just as important as using the correct amount or having the proper analysis made of the material. The lack of plant food nutrients, type of soil, climatic conditions, fertilizer available, and the specific crop all influence the methods of application.

The dry forms of fertilizers are distributed by various kinds of mechanical equipment in order to place the material where it should be in relation to the plant roots. These forms are usually placed in bands or broadcast and then mixed with the soil. However, they may be placed on the surface to be dissolved by rain and then absorbed by the soil. Knowing how to properly apply fertilizer is not sufficient. One must be aware of the optimum time to apply fertilizers to crops. These materials may be applied well before planting, at planting, or after the crop is growing. The crop, climatic conditions, type of soil, and available moisture are the important factors that aid the operator in making the proper decision as to when to apply fertilizers. Nearly all fertilizer distributed annually is applied to the seedbed or growing crops in the spring (March, April, and May). However, fall application of a balanced nutrient is gaining wide acceptance.

A thorough knowledge of the equipment used to apply all types of fertilizer is necessary for the farm operator to choose the best equipment for the farming operation. For applying dry types of fertilizers, there are several types of distributors. Some of the more prominent types are: row, broadcast, spin broadcast (mounted on trailers, tractors, or trucks), and the grain drill type. Most of the fertilizer distributed is in the solid form. However, liquid fertilizer is used on large small grain acreage. This is the newest and most expanding method of applying fertilizer. Most liquid fertilizers applied today are in some form of the nitrogen group of fertilizer elements. Usually limestone is applied by broadcasting it from trucks and trailers with spinner type spreaders.

Information on how to operate, service, and properly store fertilizer equipment is very vital to the operator. Proper utilization of barnyard manure cannot be carried on unless a good distributor is available. Barnyard manure must be applied often and regularly to the fields if it is to be properly utilized. There are two basic types of distributors available today, power take-off operated and wheel power driven.

UNIT: Fertilizers
TOPIC: Applying Fertilizers
(Information Sheet continued)

It is usually applied on top of the soil. In some cases commercial fertilizer is added to barnyard manure.

Fertilizer distributing equipment should have certain features that make the equipment desirable. These features are:

They should have an adjustment so that the rate of flow will be uniform.
The controls should be easily regulated. Applications need to be uniform and in the correct amounts.
The various forms of fertilizer (pellets, granules, powder) should be distributed with the same equipment.
The hopper should be large enough to hold a large quantity to reduce refilling operations.
A good agitator is important to keep the materials stirred and flowing at a desirable rate for most solids and some liquids.
The equipment should function the same when full or nearly empty.
The equipment should have windows or gauges that show the amount of flow or show the contents of the hopper.

Liquid and Gas Fertilizer Equipment

Satisfactory use of liquid fertilizers depends largely upon having the equipment properly calibrated. Fortunately, this is fairly simple.

Where nozzles and orifices (flow regulators) are used, manufacturers furnish information which shows the quantity of fertilizer applied at various pressures and speeds. One can determine the speed of application by placing two markers in the field 88 feet apart and getting the time (in seconds) it takes the applicator to travel this distance. To calculate the speed in miles per hour, divide the time in seconds into 60.

How to Calibrate

Calibrate the gravity flow applicators by using a needle valve to adjust the rate of flow or by changing the head alone and operating without valves. If the head alone is changed, lift the siphon breaker vent above the bottom of the fill tube to stop the flow. Equip the tank with a clear plastic hose fastened to the top and bottom of the tank. Fill the tank by pouring in 5 gallons of solution at a time. Mark the level for each 5 gallons on the head of the tank. Make a trial setting of the regulating valve or the pressure head and apply the fertilizer to a known area. The calibrated barrel head will show if the valve setting or pressure head needs changing for the amount one wishes to apply.

Anhydrous Ammonia

Anhydrous ammonia exists as a liquid under pressure but expands quickly into a gas at atmospheric pressure. It weighs about 5 pounds per gallon and contains 4.2 pounds of nitrogen per gallon. This is handled in high pressure tanks made of carbon steels, applied 4 to 6 inches in the ground. Since ammonia equipment is normally covered by state safety codes, it is not discussed here.

Phosphoric Acid

Phosphoric acid may be applied directly. Wet process or green acid is commonly used. Phosphoric acid weighs about 14 pounds per gallon and usually contains 54 percent P_2O_5 and is very corrosive to mild steel.

Use a gravity flow system. Permanent equipment should be made of type 316 stainless steel. Plastic liners can be gotten for mild steel containers. Diaphragm valves and plastic hose complete the equipment to dribble the acid on or into the ground.

Potash

Muriate of potash is generally used as a source of K_2O. As a solid, it usually exists as 62 percent K_2O equivalent. It is readily soluble in water and can be diluted to a 20 percent solution. It is a salt and very corrosive to mild steel. Apply it by gravity flow on or into the ground, using stainless steel drums or plastic containers.

Completely Neutral Solutions

Completely neutral solutions are made by combining nitrogen, phosphorus, and potash. The phosphoric acid is neutralized with anhydrous or aqua ammonia. Any additional nitrogen needed may be provided by using nitrate solutions. Potash is added in the form of muriate of potash. The resulting mixture weighs about 10 pounds per gallon and contains up to 30 pounds of plant food per 100 pounds.

This solution does not form a pressure and is practically non-corrosive. It can be applied from inexpensive steel containers on top of or beneath the surface of the ground.

Nitrogen Solutions

Solutions made from ammonium nitrate, urea, and water are non-pressure-forming.

UNIT: Fertilizers
TOPIC: Applying Fertilizers
(Information Sheet continued)

They contain 18 to 32 percent nitrogen and weigh 10 to 12 pounds per gallon. Apply this solution either on top of the ground, in the ground, or in irrigation water. Use aluminum or stainless steel containers. Avoid such materials as brass, copper, or monel.

Solutions made from ammonium nitrate and water which contain free ammonia are pressure-forming. Their nitrogen content varies from around 25 percent to 41 percent and weighs 7 to 9 1/2 pounds per gallon. Since this solution contains free ammonia, apply it to a depth of 2 to 3 inches in the ground. Use closed aluminum or stainless steel tanks.

Aqua ammonia is a combination of anhydrous ammonia and water. The nitrogen content varies from 18 to 24 percent. It is slightly pressure-forming and weighs about 7 pounds per gallon. Apply this mixture to a depth of 2 to 3 inches in the ground. Use closed mild steel containers.

Application

Liquid or gaseous forms of fertilizers are gaining very wide acceptance in crop production today. Naturally, this form of fertilizer requires methods of application different from the dry bulk type of fertilizers.

ANHYDROUS AMMONIA APPLICATOR

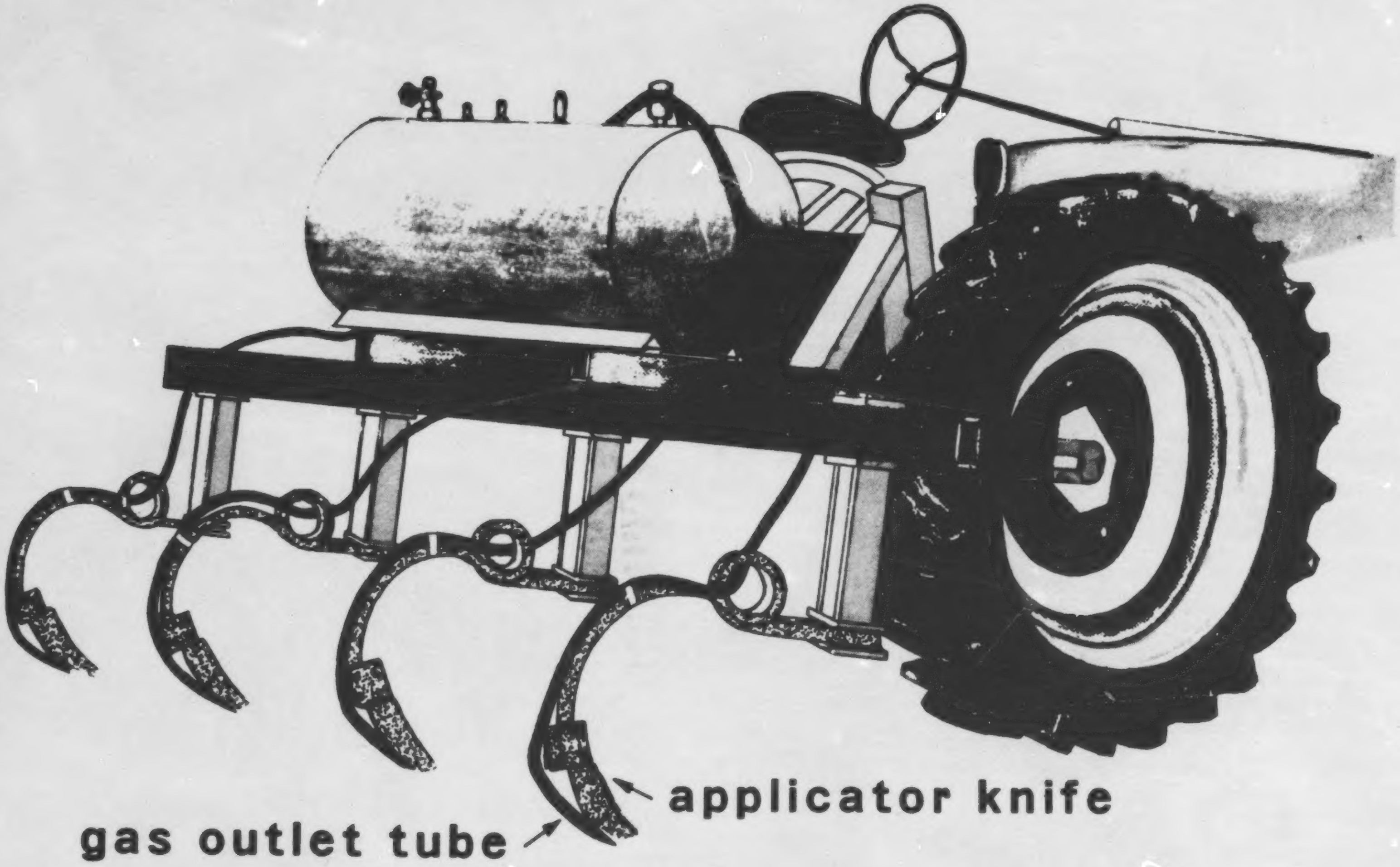

applicator knife
gas outlet tube

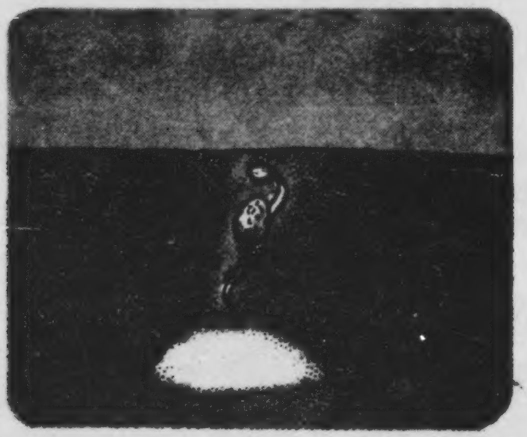
TABLE I - Summary of Recommendations

Type Fertilizer	Plant Food	Vapor Pressure at 104° F.	Design Pressure	Recommended Tank Material	Closed or Open System	Method of Application	Type System	Materials to Avoid
Anhydrous Ammonia	82% N	211 psi	250	Steel	Closed	Subsurface	Pump Pressure Differential	Brass Copper Monel
Aqua Ammonia	Up to 25% N	Up to 10 psi	15	Steel	Closed	Subsurface	Pump Air	Brass Copper
Complete Neutral Solution	Up to 30 units N-P-K	0	15	Steel Fiberglass Lined Tanks	Open	Subsurface surface	Pump Air Gravity	Aluminum Brass
Ammonium Phosphate (neutral)	Up to 30 units N-P	0	15	Steel Fiberglass Lined Tanks	Open	Subsurface surface	Pump Air Gravity	Aluminum Brass
Nitrogen Solution (Non-Pressure)	18 to 32% N	0	15	Aluminum Fiberglass Lined Tanks	Open	Subsurface surface	Pump Air Gravity	Brass Monel
Nitrogen Solution (Low-Pressure)	25 to 41% N	1 to 17	30	Aluminum Fiberglass Lined Tanks	Closed	Subsurface	Pump Air	Brass Monel Mild Steel
Phosphoric Acid	64% P_2O_5	0	15	Stainless Steel Fiberglass Lined Tanks	Open	Subsurface surface	Gravity Air	Aluminum Brass Mild Steel

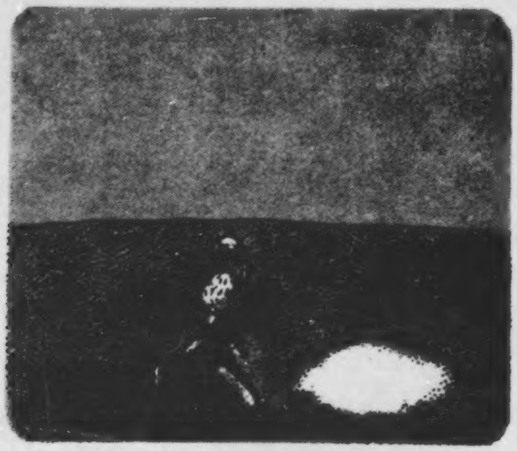
Note 1. Tanks may be lined with rubber, neoprene, polyethylene, and vinyl resins.

Note 2. If other means are used to give the tank rigidity, it is not necessary to design for 15 psi where zero pressure is to be encountered.

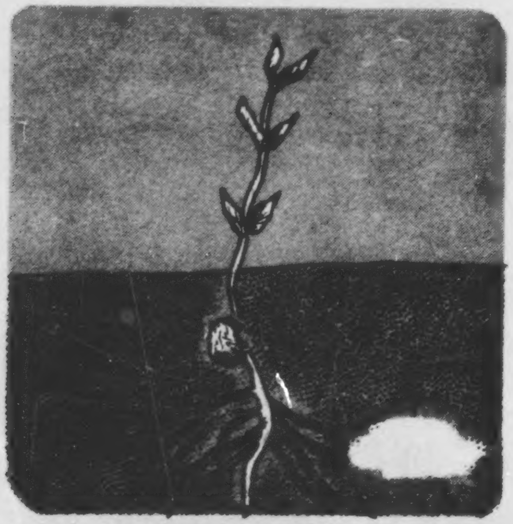
Placement of Fertilizer



Bottom Dressing the Seed

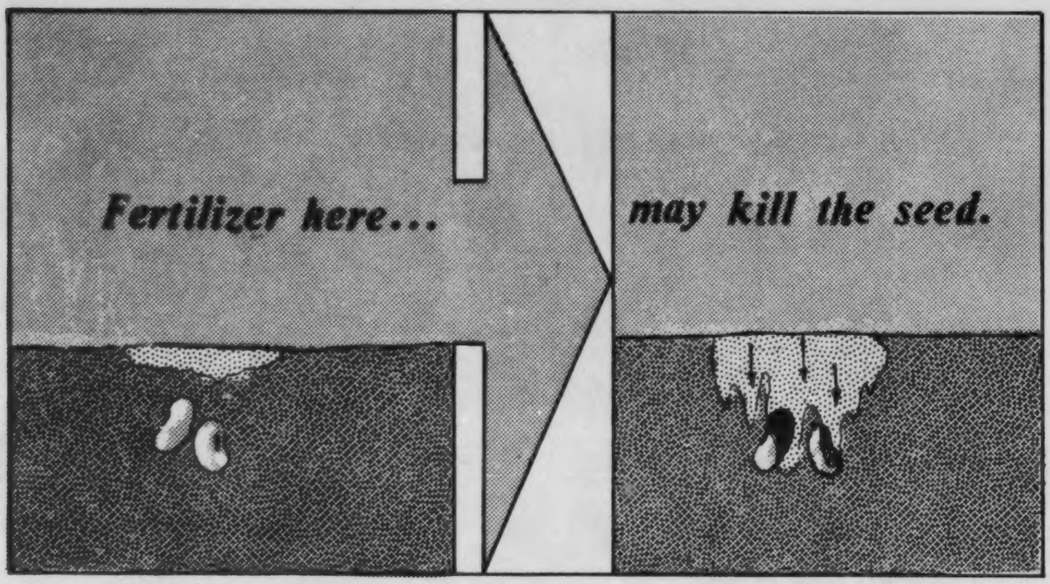


Side Dressing the Seed

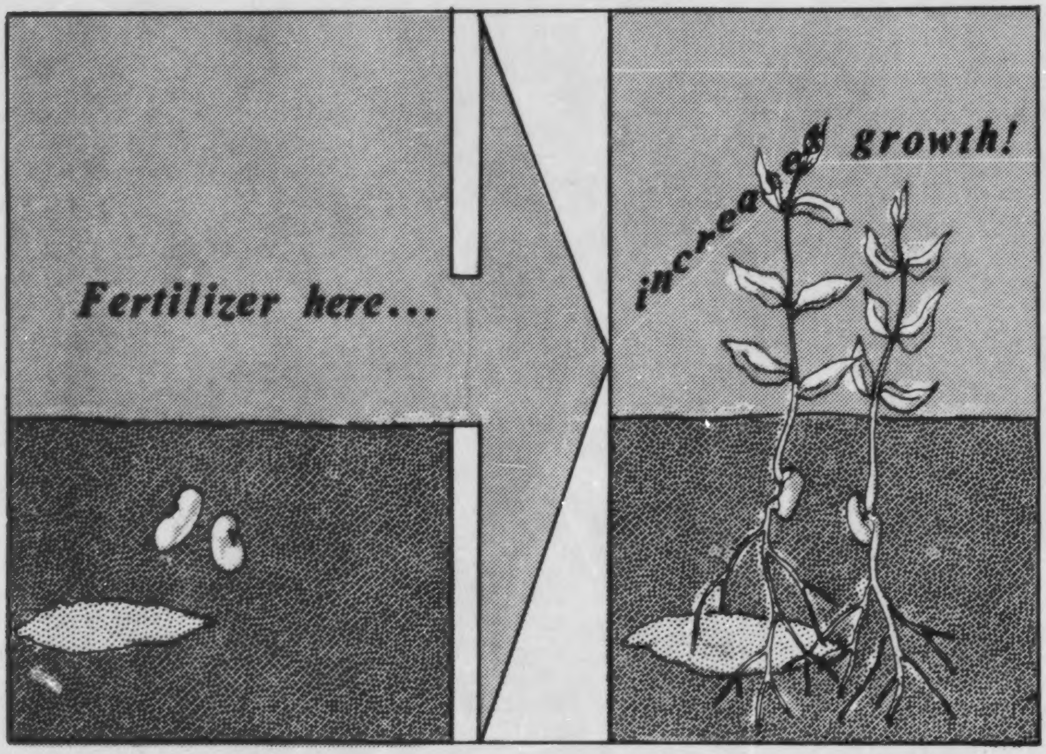


Side Dressing the Seedling

Placement of Fertilizer Is Important


Fertilizer here...
may kill the seed.

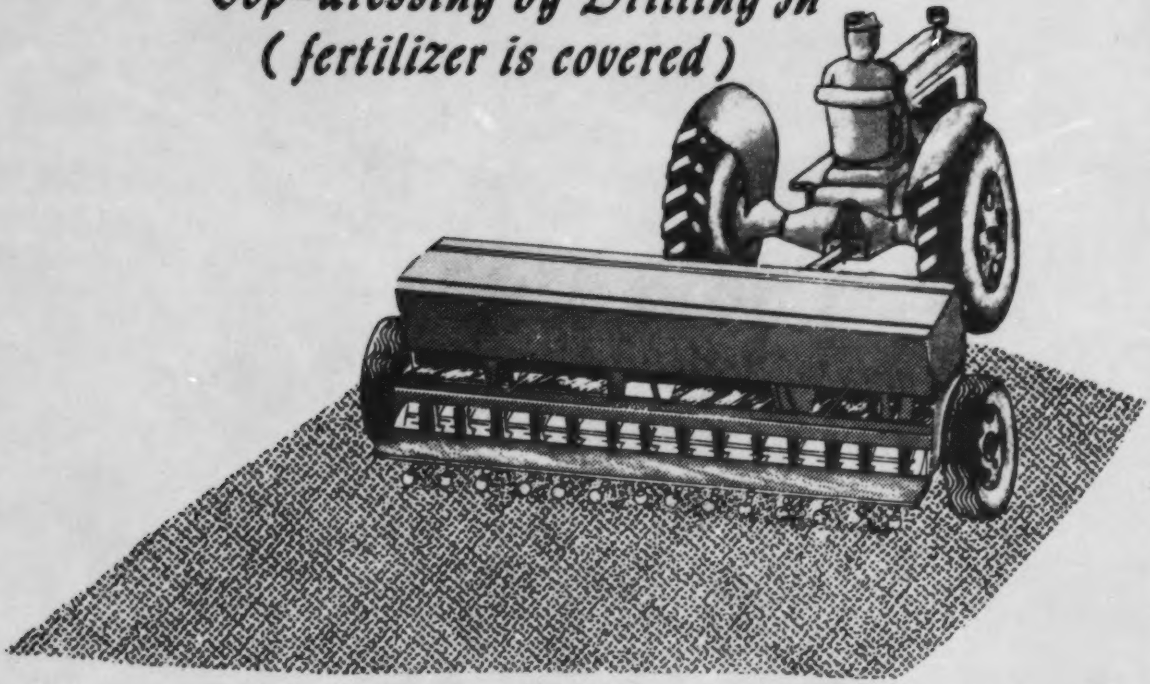
Fertilizer placed in contact with or too near the seed may prevent the seed from germinating.


Fertilizer here...
increases growth!

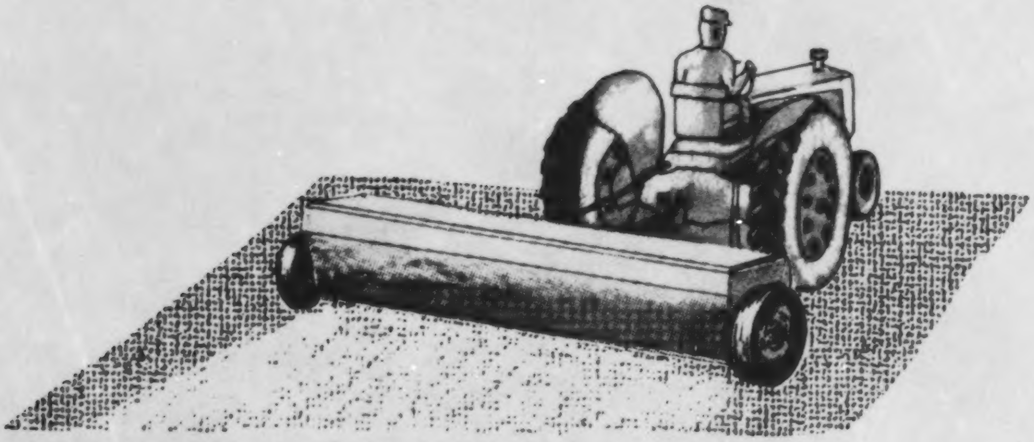
Fertilizer placed below and to one side of the seed will not prevent germination and will increase seedling growth.

Application of Fertilizer

Top-dressing by Drilling In
(fertilizer is covered)

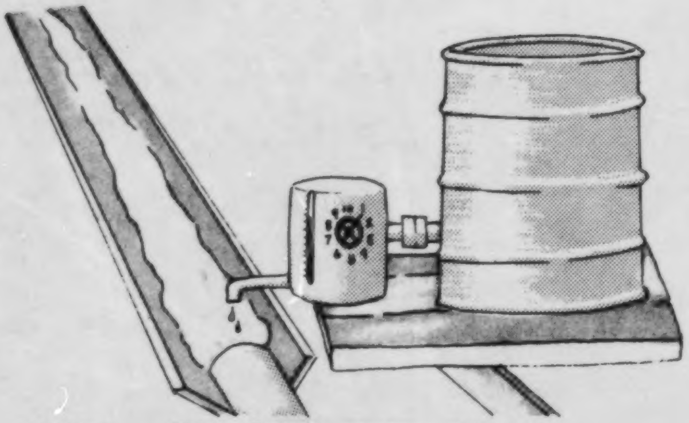


Top-dressing by Broadcasting
(fertilizer is uncovered)

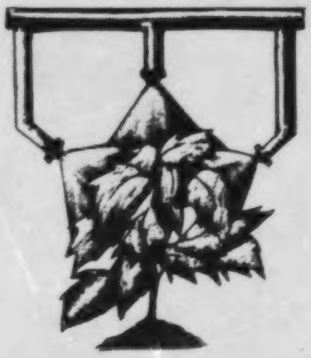


☆ *Phosphorus must be plowed into the soil in order to be available to the root systems of plants.*

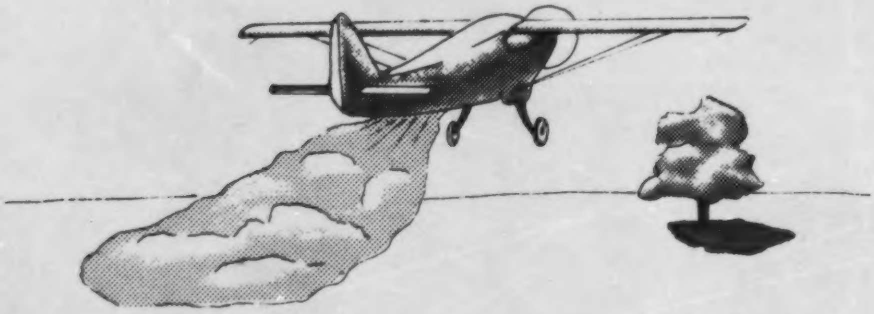
Application of Fertilizer By:



1. Applying Fertilizer To Irrigation Water,



2. Foliage Spraying,



3. and Applying Fertilizer By Airplane.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Soil Types and Fertilizer Use

OBJECTIVE: To acquaint the student with the reaction of fertilizers on special types of soils and the value of soil testing to determine plant needs.

REFERENCES:

Required:

1. Information Sheet, "Soil Types and Fertilizer Use".
2. Using Commercial Fertilizer, McVickar, pp. 160-166.
3. Our Soils and Their Management, Donahue, pp. 40-48.
4. "Soil Texture", Illinois, VAS 4030.
5. The Fertilizer Handbook, pp. 85-98.

QUESTIONS OR ACTIVITIES:

1. Do some soils react differently to fertilizers? Why?
2. The solid portion of a soil is made up of what two things?
3. What are the three groups of mineral particles based on size?
4. How are soil textural classes determined?
5. What is the difference between an acid and sweet soil?
6. Why is it important to test soils for fertility?
7. What is the percent of sand, silt, and clay in sandy loam, clay loam, sand, and clay soils?
8. How is the texture determined in fine, medium, and coarse soils?
9. How does the soil pH affect the availability of nitrogen, phosphorus, and potassium to the plant?

Information Sheet
on
SOIL TYPES AND FERTILIZER USE

The crop farmer must have an understanding of the various types of soils and how they will react to the application of commercial fertilizers. A background of information about soil texture and how soils are formed is essential if the farmer expects to gain the optimum response from his fertilization program.

All soil particles have electrical or chemical attractive forces that cause them to latch on to fertilizers that are added to the soil.

Another factor that plays an extremely important part in the response of fertilizers is the soil reaction or the pH range. This range refers to the degree of acidity or "sourness" or alkalinity or "sweetness" of a soil. Most plants have a certain range of soil reaction or pH under which they grow best and produce the most.

By testing the soil, the crop farmer can determine the fertilizer needs for the crop to be grown. Testing soils for fertility level is so important it should not be left to chance if maximum production goals are to be realized.

Soil, in some respects, is like people; it needs a periodic checkup. Through this periodic checkup, along with good management practices, the highest returns on investment in fertilizer and lime can be received. In order to know the proper amount of fertilizer and lime the soil needs, the soil should be tested. This test will provide a scientific basis, rather than a haphazard, hit-and-miss basis for correct usage.

The following information will be helpful to the farm operator in analyzing his soil test and making the necessary decisions to carry out recommendations for fertilizer based on his soil test results.

SOIL TEXTURAL CLASSES

SAND — DRY: LOOSE AND SINGLE GRAINED; FEELS GRITTY. MOIST: WILL FORM VERY EASILY-CRUMBLED BALL. SAND--85-100%, SILT--0-15%, CLAY--0-10%.

LOAMY SAND — DRY: SILT AND CLAY MAY MASK SAND; FEELS LOOSE, GRITTY. MOIST: FEELS GRITTY; FORMS EASILY-CRUMBLED BALL; STAINS FINGERS SLIGHTLY. SAND--70-90%, SILT--0-30%, CLAY--0-15%.

SANDY LOAM —DRY: CLODS EASILY BROKEN; SAND CAN BE SEEN AND FELT. MOIST: MODERATELY GRITTY; FORMS BALL THAT CAN STAND CAREFUL HANDLING; DEFINITELY STAINS FINGERS. SAND--43-85%, SILT--0-50%, CLAY--0-20%.

LOAM —DRY: CLODS MODERATELY DIFFICULT TO BREAK; MELLOW, SOMEWHAT GRITTY. MOIST: NEITHER VERY GRITTY NOR VERY SMOOTH; FORMS A FIRM BALL; STAINS FINGERS. SAND--23-52%, SILT--28-50%, CLAY--7-27%.

SILT LOAM —DRY: CLODS DIFFICULT TO BREAK; WHEN PULVERIZED FEELS SMOOTH, SOFT AND FLOURY, SHOWS FINGERPRINTS. MOIST: HAS SMOOTH OR SLICK "BUTTERY" OR "VELVETY" FEEL; STAINS FINGERS. SAND--0-50%, SILT--50-88%, CLAY--0-27%.

CLAY LOAM — DRY: CLODS VERY DIFFICULT TO BREAK WITH FINGERS. MOIST: HAS SLIGHTLY GRITTY FEEL; STAINS FINGERS; RIBBONS FAIRLY WELL. SAND--20-45%, SILT-15-53%, CLAY--27-40%.

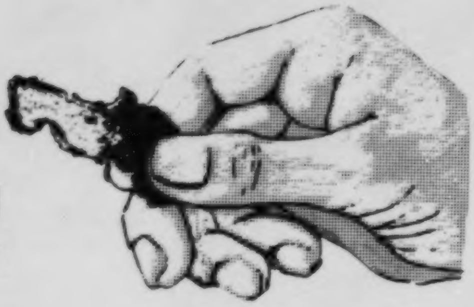
SILTY CLAY LOAM —SAME AS ABOVE BUT VERY SMOOTH. SAND--0-20%, SILT--40-73%, CLAY--27-40%.

SANDY CLAY LOAM — SAME AS FOR CLAY LOAM. SAND--45-80%, SILT--0-28%, CLAY--20-35%.

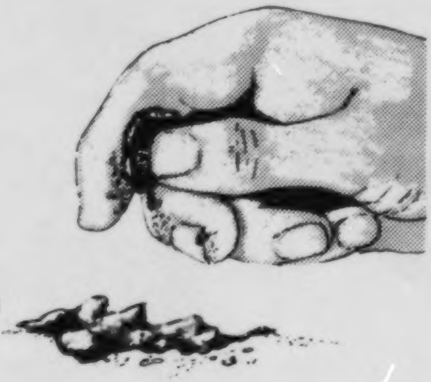
CLAY — DRY: CLODS CANNOT BE BROKEN WITH FINGERS WITHOUT EXTREME PRESSURE. MOIST: QUITE PLASTIC AND USUALLY STICKY WHEN WET; STAINS FINGERS. (A SILTY CLAY FEELS SMOOTH, A SANDY CLAY FEELS GRITTY.) SAND--0-45%, SILT--0-40%, CLAY--40-100%.

HOW TO DETERMINE SOIL TEXTURE

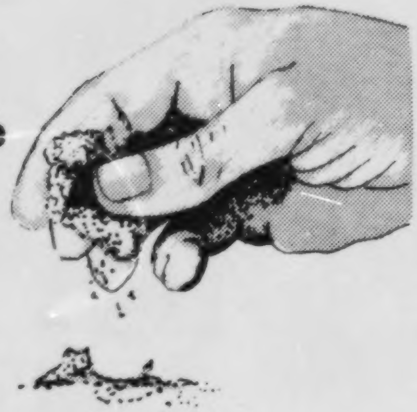
If you can form a long pliable ribbon from a ball of moistened soil, the soil is fine textured and may be clay, silty clay, or sandy clay.



If no ribbon forms, and the soil feels smooth with no or slight grittiness; the soil is medium textured and may be loam, silt loam, or silt.

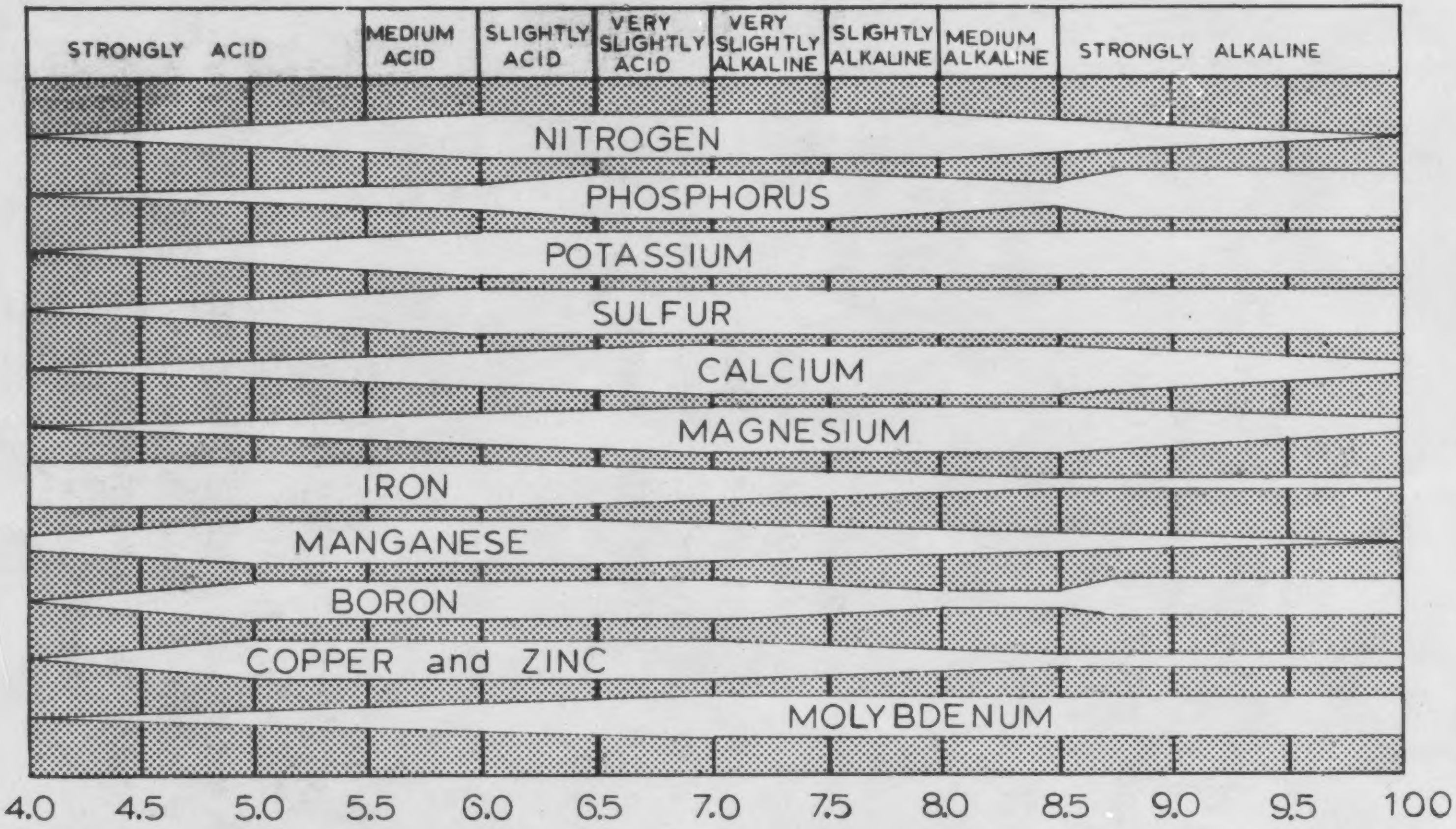


If the soil crumbles easily, feels markedly gritty with a lack of smoothness, it is coarse textured and may be sandy loam or loamy sand depending on how much sand is present.



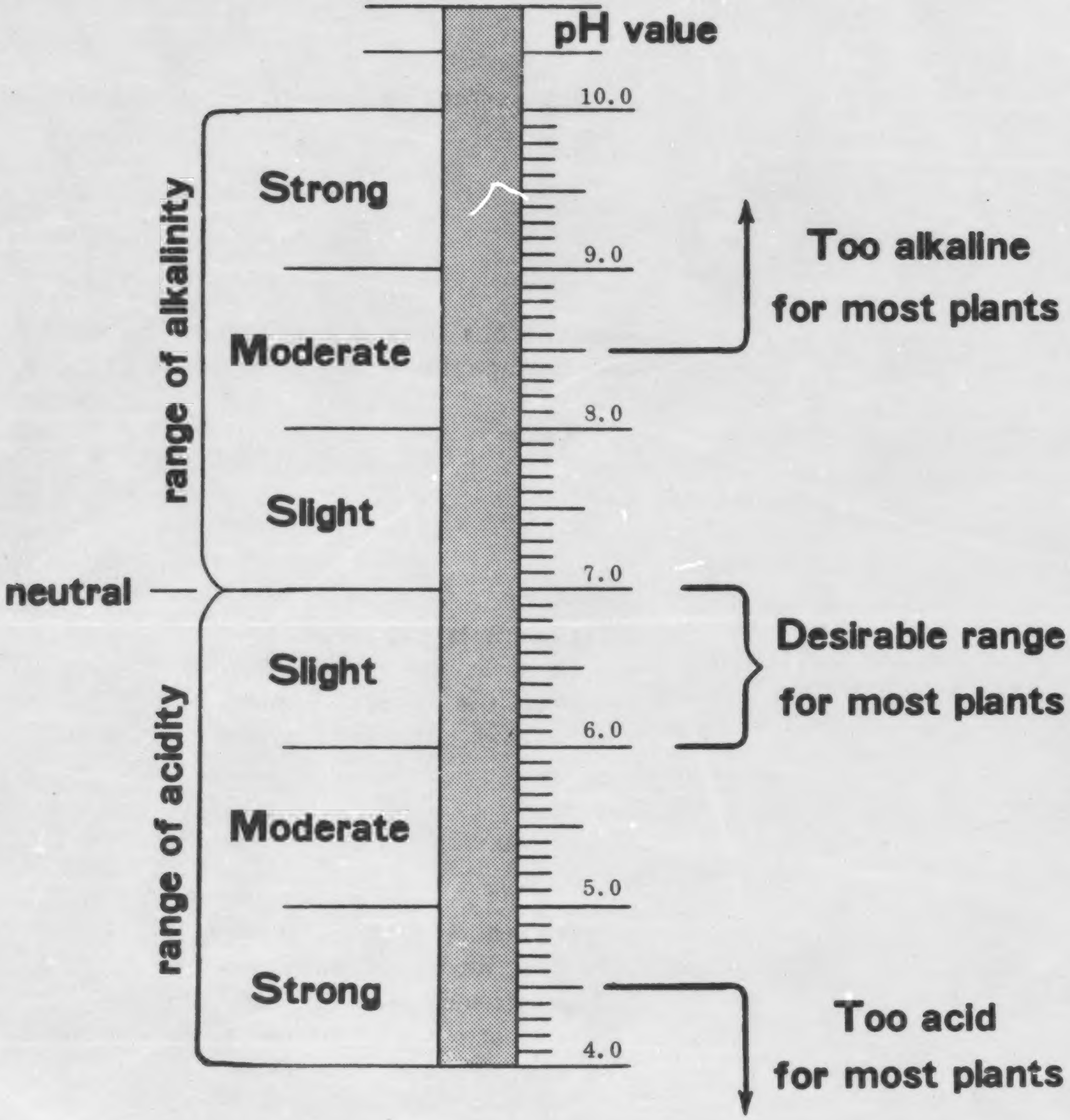
SOIL PH AFFECTS AVAILABILITY OF PLANT NUTRIENTS

NOTE: AVAILABILITY OF NUTRIENTS TO PLANTS DECREASES AS WIDTH OF LINE DECREASES.

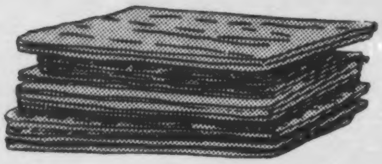


pH SCALE FOR SOIL REACTION

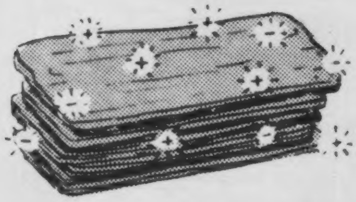
(pH OF 4-10)


pH value
10.0
9.0
8.0
7.0
6.0
5.0
4.0
range of alkalinity
Strong
Moderate
Slight
neutral
range of acidity
Slight
Moderate
Strong
Too alkaline for most plants
Desirable range for most plants
Too acid for most plants

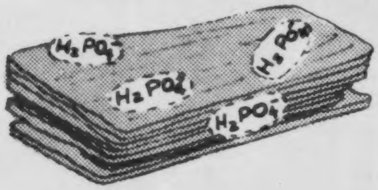
SOIL REACTIONS OF THE MAJOR PLANT NUTRIENTS



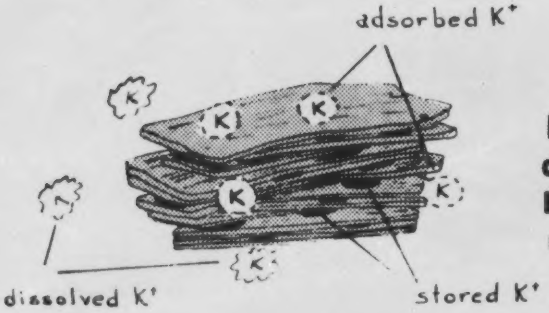
A soil particle is made up of layers.



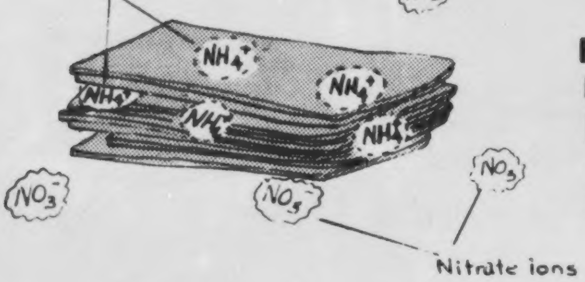
Its surface is electrically charged.


$H_2PO_4^-$
$H_2PO_4^-$
$H_2PO_4^-$
$H_2PO_4^-$

Phosphorous ions are adsorbed tightly to the surface by attractions to + charges.

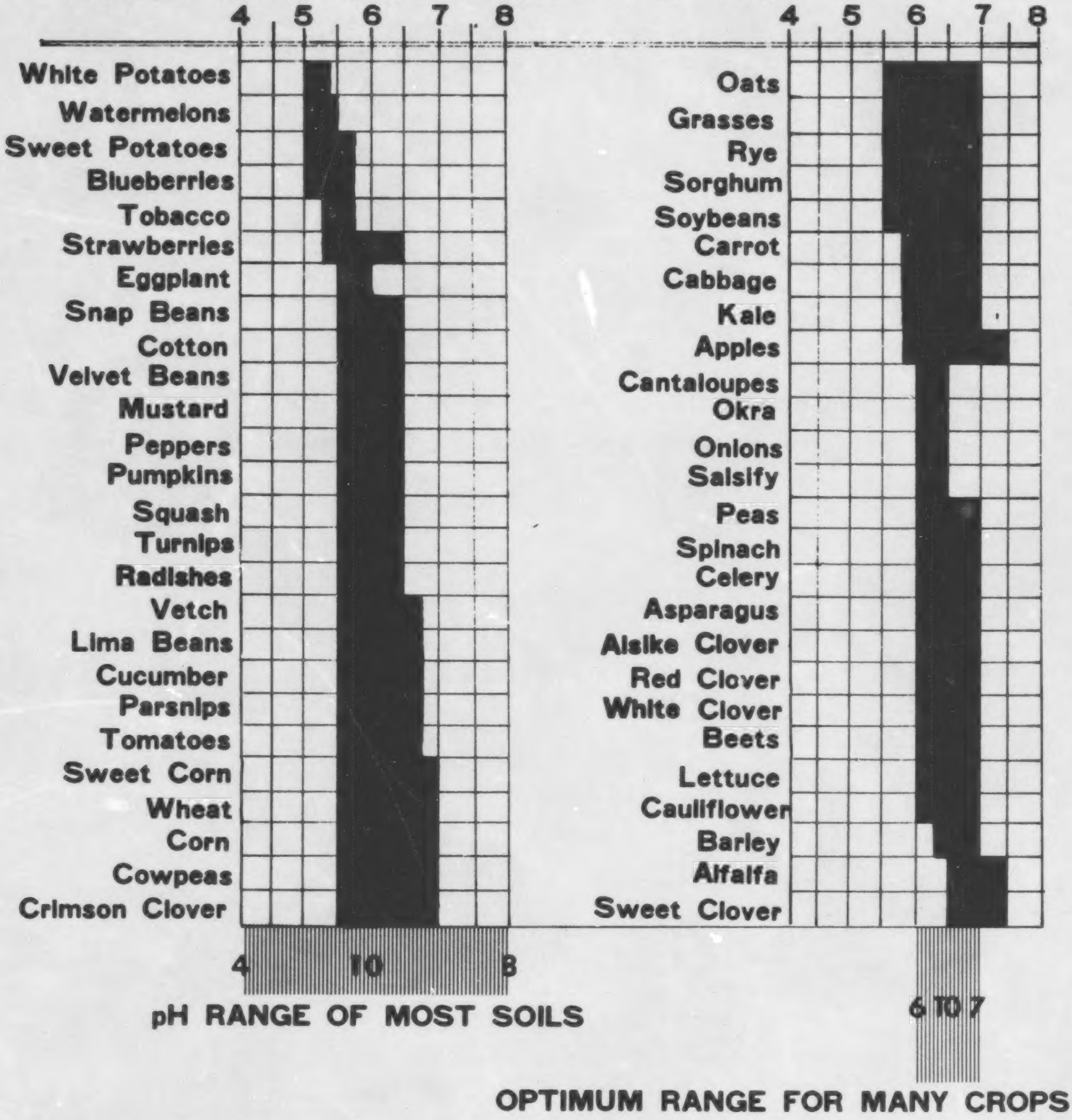

adsorbed K$^+$
K
K
K
K
K
K
K
dissolved K$^+$
stored K$^+$

Potassium is adsorbed to the surface, dissolved in the water, and stored between the layers. Stored K$^+$ are unavailable until adsorbed K$^+$ are used up.

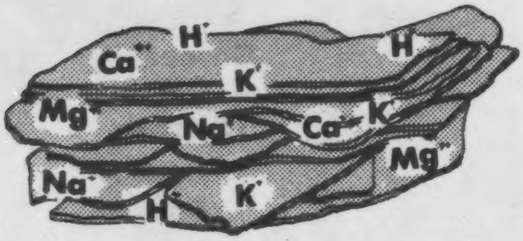

Ammonium ions
NO_3
NH_4^+
NH_4^+
NH_4^+
NH_4^+
NH_4^+
NO_3^-
NO_3^-
NO_3
Nitrate ions

Nitrogen is made available to plants in the forms of ammonia and nitrate. Nitrate ions are dissolved in the soil water only. Ammonium ions are adsorbed to the surface.

SOIL pH NECESSITIES FOR SOME COMMON CROPS



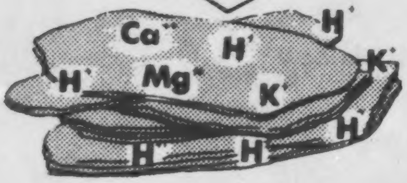
ACID AND *SWEET* SOILS

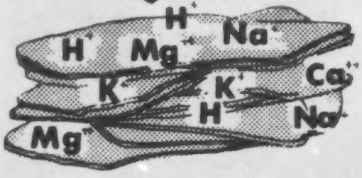

H+
Ca++
H+
K+
Mg++
Na+
Ca++
K+
Mg++
Na+
K+
H+

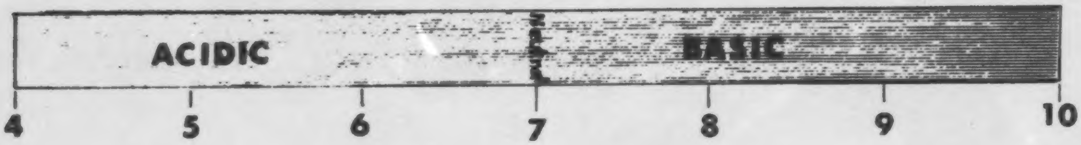
Nutrients, as electrically charged ions, are attracted to the surface of soil particles and are said to be "adsorbed".

A
soil
particle
with mostly
Hydrogen ions tests
"Acid"

A
soil
particle
with mostly
Basic ions tests
"Sweet"


Ca++
H+
H+
H+
Mg++
K+
K+
H+
H+
H+


H+
H+
Mg++
Na+
K+
K+
Ca++
H+
Na+
Mg++

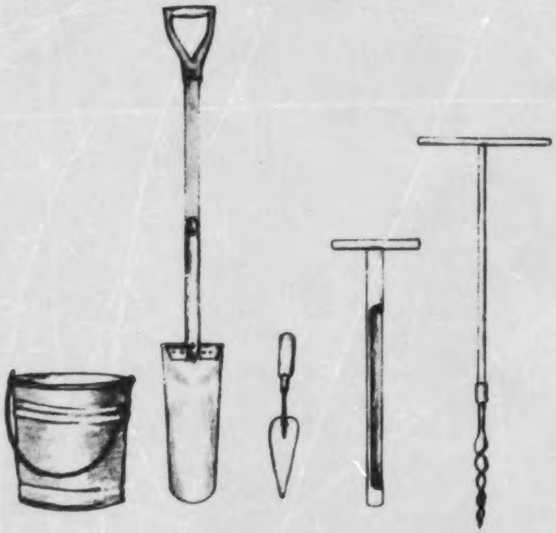

ACIDIC
BASIC
4
5
6
7
8
9
10

A Soil Test Is Only As Good As The Sample

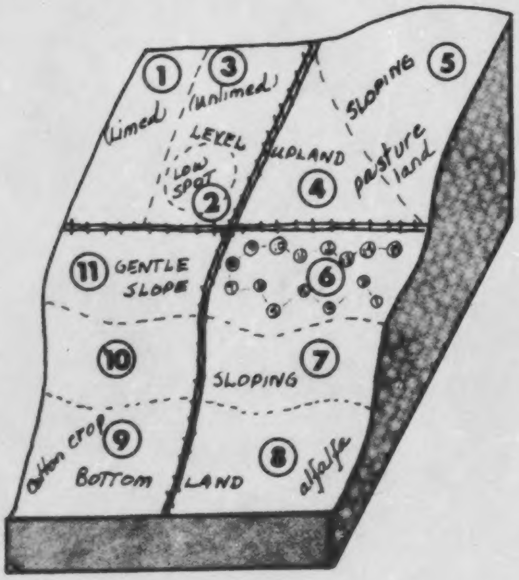
12 STEPS TOWARD A GOOD SAMPLE

1. Get sample cartons and information sheets from your county agent. Make soil test early - weeks before planting.

2. Get a clean bucket, spade and knife or a soil probe or auger to use in removing the soil.



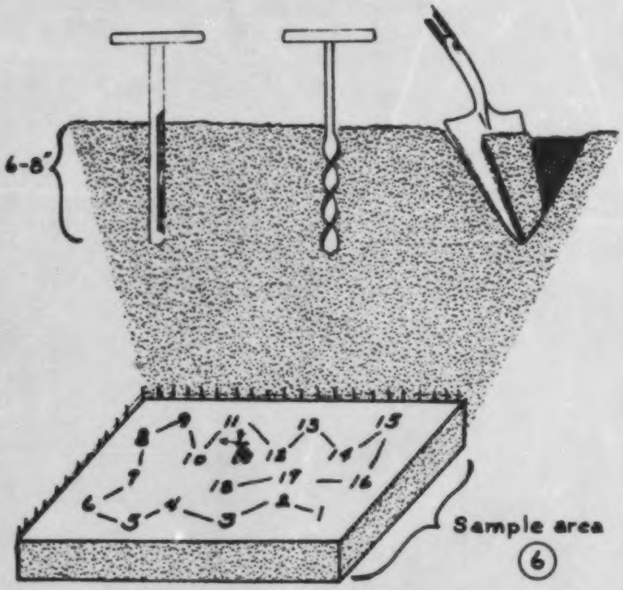
3. Divide your field into areas for sampling according to the different soil conditions present.


①
③
⑤
limed
unlimed
LEVEL
LOW SPOT
②
SLOPING
UPLAND
④
pasture land
⑪ GENTLE SLOPE
⑥
⑩
SLOPING
⑦
cotton crop
⑨
BOTTOM
LAND
⑧
alfalfa

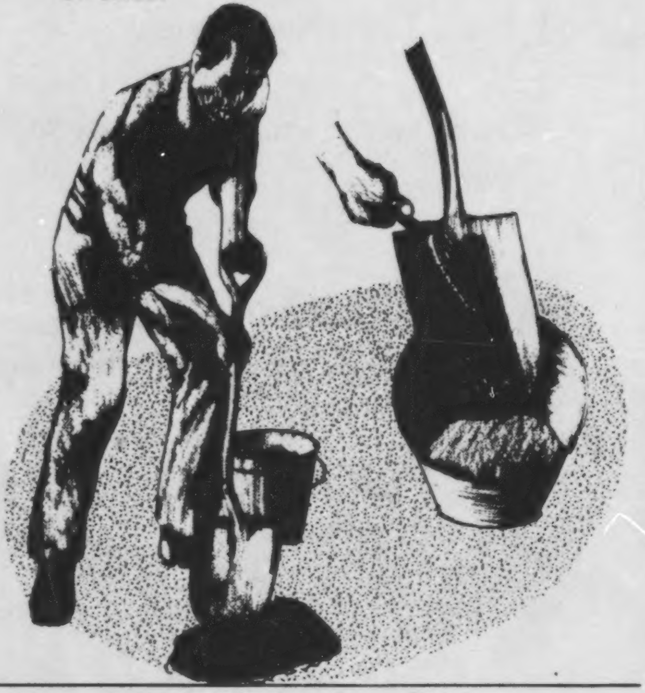
4. Avoid sampling from unusual areas, or sample them separately.

Limed Areas
Dead Furrows
Wind Breaks
Snow Fences
Manured Spots
Wet Spots
Near Roads
Near Trees
Eroded Areas
Muck Areas

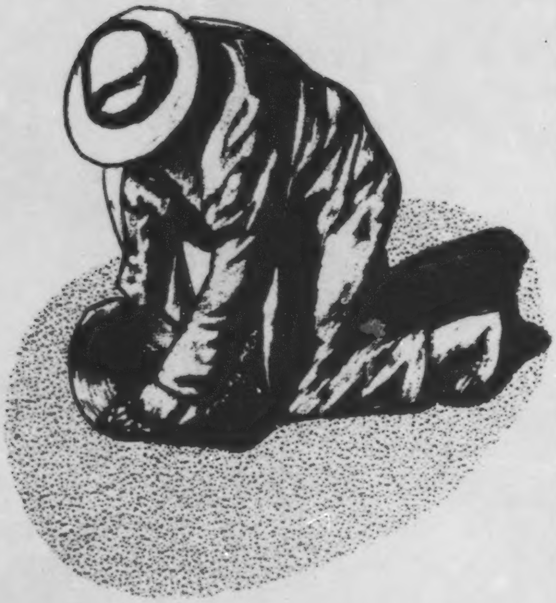
5. Take soil to plow depth from at least 15 spots for each sample area.



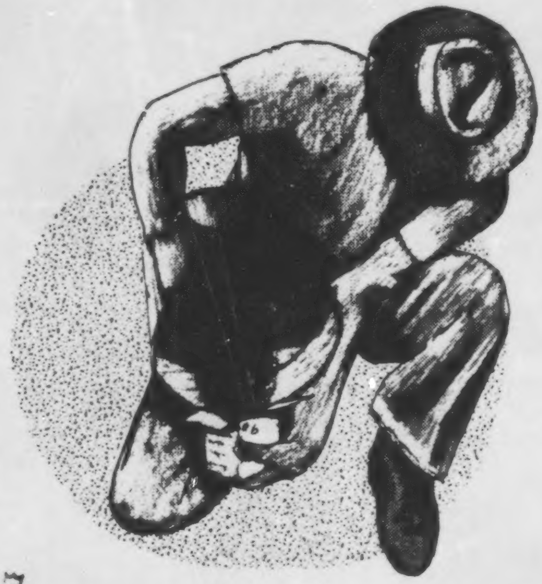
6. If spade is used, save soil from middle of slice.



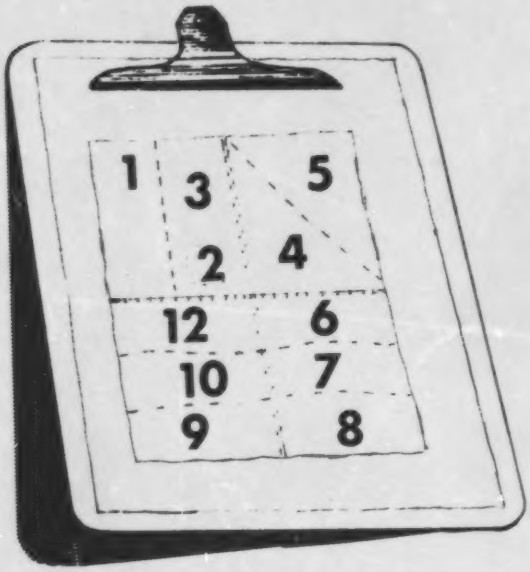
7. Place all samples from a sample area into a clean pail and mix thoroughly.



8. Pour the mixture of a sample area into a carton and label with its sample number, and other information called for.



9. Diagram your field the way you sampled it being sure the sampled areas are labeled the same as the soil sample cartons.

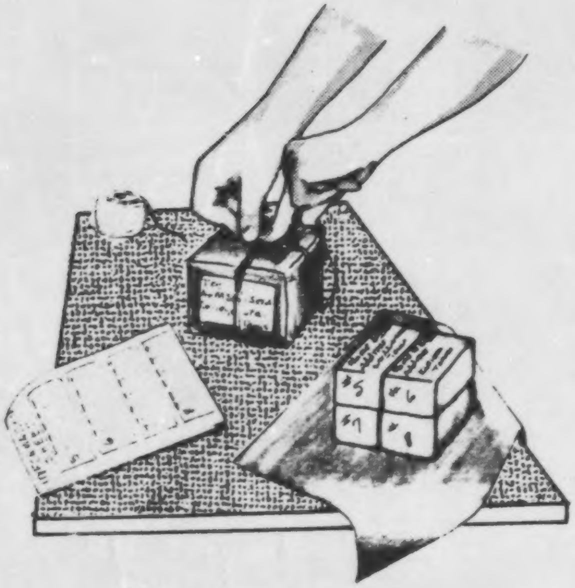


10. Fill out the information sheet giving as much information as you can about:

Previous crop
Crop to be grown
Last liming date and rate
Whether manure will be used
Depth of plowing
Soil type
Type of drainage
Yield goal
Whether irrigation will be used
Special problems or conditions

for each sample area.

11. Wrap samples securely and mail to the soil testing laboratory.



12. Follow the soil test recommendations and get the materials you need from your local co-op.

Fertilizer
10-20-10

D-494 (Dist. 4, 5, 8, 9, 10 & 11)

TEXAS A&M UNIVERSITY
TEXAS AGRICULTURAL EXTENSION SERVICE
SOIL TESTING LABORATORY

SOIL SAMPLE INFORMATION SHEET FOR FIELD CROPS

To aid in interpreting the soil test and making recommendations, fill in the following information sheet as completely as possible and submit with your soil samples. Each soil sample should be marked with your name and sample number which should correspond with the information furnished on this sheet. Cost of testing is $2 per sample. See mailing instructions on opposite side under Step 4.

NAME.. COUNTY..
ADDRESS.. LOCATION IN COUNTY..
(NE, S, SW, W, NW, etc.)
POST OFFICE.. DATE..
EXTRA COPY TO: NAME..
ADDRESS..

SAMPLES TAKEN BY:
Farmer....................
Co. Agt....................
Dealer....................
ASC....................
SCS....................
Vo-Ag....................
4-H....................

A. SOIL CONDITIONS: (Use ditto and check marks wherever possible)

Laboratory Number (Do not write in this space)	Your Sample Number	Acres in Sample	Location			Irrigated		Soil Type (if known)	Remarks
			Upland	Bottom	2nd Bottom	Yes	No		

B. CROPS TO BE GROWN

Sample Number	Next 2 Crops			
	Next Crop 196....		Year After 197....	
	Crop	Desired Yield	Crop	Desired Yield

C. CROPPING HISTORY

Last 2 Crops					
Present or Last Crop 196....				Previous Crop 19....	
Crop	Yield	Fertilizer			
		Grade	Lb./A	Crop	Yield

D. GENERAL: (Please answer following question if applicable to these samples).

1. Will Small Grain be grazed? No .... Yes .... Which fields?..
2. Has Lime been applied during past two years? Which fields?..
3. Will grass be used for hay? No .... Yes .... Which fields?..
4. Will grass be used for grazing? No .... Yes .... Which fields?
5. If grazed, how many animal units per acre? ....
6. Will a legume be grown in pasture? No .... Yes .... Which fields
   If so, what ....
7. What is the primary pasture grass?
   Common Bermuda............
   Coastal Bermuda............
   Dallis Grass............
   Bahia Grass............
   Love Grass............
   Native Grass............

D-616

THE A&M COLLEGE OF TEXAS
TEXAS AGRICULTURAL EXTENSION SERVICE
SOIL TESTING LABORATORY

INFORMATION SHEET FOR SALINITY ANALYSIS OF SOIL SAMPLES

To aid in interpreting the results of the salinity analysis, fill in the following information sheet as completely as possible and submit with your soil samples. Mark each sample plainly with your name and sample number to correspond with the information furnished below. See the reverse side of this sheet for costs and procedure for sample collection and mailing.

NAME...COUNTY...

ADDRESS...LOCATION IN COUNTY...............................
(NE, S, SW, W, NW, , etc.)

POST OFFICE.......................................DATE...

EXTRA COPY TO: NAME..

ADDRESS..

SAMPLES TAKEN BY:
Farmer..................
Co. Agt..................
Dealer..................
ASC..................
SCS..................
Vo-Ag..................
4-H..................

A. SOIL CONDITIONS: (Use ditto and check marks wherever possible)

Laboratory Number (Do not write in this space)	Your Sample Number	Acres in Sample	No. of Locations per Sample	Depth of Sample	Slope			Internal Drainage			Location			Physical Condition					Depth of Topsoil to Heavy Subsoil	Soil Type (if known)
														Topsoil			Subsoil			
					Level	Slight	Moderate	Good	Fair	Poor	Upland	Bottom	2nd Bottom	Loose	Mellow	Tight	Loose	Tight		

B. CROPPING HISTORY

1. List crops grown and yield for the past 3 years. 196........? ....
196........? .... 196........? ....
2. List crops you plan to grow..
3. List rate, kind and method of application of fertilizer on the affected crops................................
....

C. GENERAL

1. How long has land been cultivated?.............................. How long irrigated?..........................
2. Is there a high water table? Yes............ No............ If so, give depth to water table..................
3. What is the source of irrigation water?............................ Has it been analyzed?......................
4. Have any soil amendments (gypsum, sulfur, sulfuric acid, limestone) been applied?..................
How much?.. When?..
5. Describe any difficulties you have on this area..
....
6. Describe plant growth symptoms on salt affected area..
....

SEND A COPY OF YOUR LATEST WATER ANALYSIS WITH THESE SAMPLES IF AVAILABLE.

PROCEDURE FOR TAKING SOIL SAMPLES FOR SALINITY ANALYSIS

GENERAL

Each sample submitted should be a composite from a representative area. Take at least 10 small samples and mix thoroughly. From this, take about 1 quart for the composite samples. For land that is bedded for row crops, take samples in the furrow. Samples can be taken with a soil auger, soil probe or spade.

GENERAL FIELD SAMPLING

To determine whether a salinity problem exists in a field where it is not obvious, use the standard soil sampling procedure. This consists of sampling each uniform area or soil type within a field. Take a separate composite sample of each soil type as suggested above.

SAMPLING TROUBLE SPOTS

When sampling trouble spots (poor growth, barren spots, etc.), sample the bad area and also sample the surrounding good area. Keep these two samples separate for thorough analysis of the situation. Composite samples should be taken from at least 2 depths of 0-12 and 12-24 inches. Sampling at deeper depths may be desirable for orchards and deep rooted plants.

POOR SEED GERMINATION OR SEEDLING GROWTH

To determine if poor germination or poor seedling growth is due to salt, a composite sample can be taken from the seed area. Remove the surface crust and take samples from the 1 to 4-inch depth directly in the row.

SAMPLING ORCHARD SOILS

Some fruit and nut trees are sensitive to salt accumulations. Composite samples from 0-12, 12-24, 24-36 and 36-48 inches in depth need to be taken. If there is a trouble spot, take samples from this area and also sample the surrounding good area.

MAILING PROCEDURE AND COSTS OF TESTING

Place samples in a waxed sack or carton if available, securely package and mail to Soil Testing Laboratory, Texas Agricultural Extension Service, College Station, Texas, together with the information sheet and soil testing fee. The fee for a salinity analysis of soil is $4.00 per sample.

INFORMATION SHEET ON SOIL SAMPLES FOR RESEARCH PURPOSES

Date..

Unit of TAES.. Address..

Individual to whom results should be sent..

Date samples collected..Project no. ....

Soil type..

Past cropping history..

Past fertilizer use..

Nature of study and crop..

Should fertilizer recommendations be made from current year?..

Additional information for off-station trials:

Farmer cooperator..

County..

Lab. no.	Field or sample no.	Depth of sample	Lab. no.	Field or sample no.	Depth of sample	Lab. no.	Field or sample no.	Depth of sample

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Irrigation

TOPIC: Importance of Irrigation

OBJECTIVE: To lead the student to consider the importance and feasibility of irrigating.

REFERENCES:

Required:

1. Information Sheet, "Importance of Irrigation".
2. Our Soils and Their Management, Donahue, pp. 367-370.

QUESTIONS OR ACTIVITIES:

1. How old is the practice of irrigating?
2. Where was irrigation practiced thousands of years ago?
3. List the water requirements in acre-inches for cotton, small grain, corn, pasture, vegetables, and fruits.
4. What is irrigation?
5. What are the principal methods of irrigating?
6. What are some of the soil factors that affect the usefulness of irrigation to the crop farmer?
7. How does irrigation water move in the soil and on what does this depend?
8. What effect will depth and layering of the soil have on irrigation for crops?
9. What is an acre inch and an acre foot of water? How long will it take to cover one acre one inch deep, if the water is flowing at one cubic foot per second?
10. What is the difference in the labor (net) income of irrigated and nonirrigated cotton farms in Texas High Plains?
11. Describe one easy method of determining when to irrigate.

Information Sheet
on
IMPORTANCE OF IRRIGATION

History of Irrigation Practices

BEFORE 200 B. C.

Water from the Nile was used to irrigate crops in the desert lands of Egypt about 3300 B. C. The world's oldest dam was built over 5000 years ago on the Nile, in Egypt, to furnish water for drinking and irrigation.

The Chinese began irrigating their farm lands at least 4500 years ago. It is believed that the Chinese developed the water ladder for lifting water from streams and reservoirs.

Early writings point out that the country south of India was very prosperous because two crops per year were harvested from the fertile land. Irrigation practices permitted Ceylon to produce an abundance of food in the semiannual harvest.

AFTER 200 B. C.

China built the Tu-Kiang Dam about 200 B. C. It still furnishes water for about 500,000 acres of rice.

The Sui Empire (589-618 A. D.) constructed the 700 mile long Grand Canal in China to furnish water for drinking and to irrigate rice crops.

The Indians of North America constructed canals in the arid regions of the west to irrigate their corn. These irrigation practices existed as early as 700 A. D.

The Mormons pioneered irrigation for crop production in the United States about the middle of the nineteenth century. The Spanish priests also developed irrigation in the Western states, but the irrigation projects were usually small (gardens, orchards, or vineyards).

In 1890, over three and one half million acres of land were under irrigation in the Western states. Texas alone has over six and one half million acres of raw crop and pasture land under irrigation. The 1965 agricultural census estimated that there are 40,000,000 acres irrigated in the United States.

UNIT: Irrigation
TOPIC: Importance of Irrigation
(Information Sheet continued)

The Meaning of Irrigation

There are several definitions that may be applied to the term irrigation.

Irrigation is a way of supplying water to the soil artificially, is maintaining a continuous supply of moisture to plant seedling and plant root zones in the soil.

The importance of irrigation is shown by the following objectives:

Add water to the soil in order to insure prompt seed germination (Preplant irrigation).

Provide the proper amount of water for plant growth (Post-plant irrigation).

Reduce the chances of producing a short crop due to drought (Preplant and Post-plant irrigation).

Make a more favorable plant environment for plant growth, either by cooling the soil or protecting the plant from a freeze. Also, plow pans are softened by adequate soil moisture.

Dilute or wash out salts that become concentrated in the soil. Improve the quantity and quality of crops produced.

The Principal Methods of Irrigation

Sprinklers - Water is sprayed through the air, similar to rainfall by sprinklers operated at pressure up to 120 pounds. Water movement is downward in the soil.

Crop adaptability - All major farm crops except rice

Soil adaptability - All irrigable soils suitable for growing field crops, perennial grasses, and legumes. This method is especially adapted to sandy soils that take in water rapidly.

Other features to consider - A good method to irrigate steep, shallow, or rolling soils; water can be controlled to provide uniform wetting; the initial and operating costs are expensive; evaporation rate may be high due to weather conditions; and labor costs may be high due to pipe movement.

Gravity irrigation - Water flows by gravity in a canal or underground pipe and disperses in the following methods: furrows, contour borders, and graded borders. Water movement is downward and outward in rows and downward in border irrigation.

UNIT: Irrigation
TOPIC: Importance of Irrigation
(Information Sheet continued)

Crop adaptability - Furrows are used for row crops; contour borders are used for rice, pasture, small grain, or orchards; graded borders are used for pasture, small grain, and hay crop irrigation.

Soil adaptability - Medium-to-fine textured soils with not more than two feet of slope per 100 feet

Other features to consider - Initial cost is usually less than sprinkler (overhead) irrigation; labor costs are low; insecticides can be used on the foliage; may require land leveling; and graded borders may interfere with farming.

Irrigation Operating Cost

Ground water operating cost on a well 14 inches in diameter and 140 feet deep, costs a few cents above $3.00 per acre foot. One acre foot of water means the amount of water to cover one acre, one foot deep. This amount of water is equal to 43,560 cubic feet. The operation cost estimates are based upon the use of a 45 horsepower diesel engine lifting the water approximately 77 feet.

Soil Properties Important to the Irrigation Program

The four major soil properties are: texture, structure, depth, and layering.

These properties help define the following characteristics of the soil:

Available moisture - The soil's capacity to store water for plant use

Permeability - The rate of movement of water through the soil

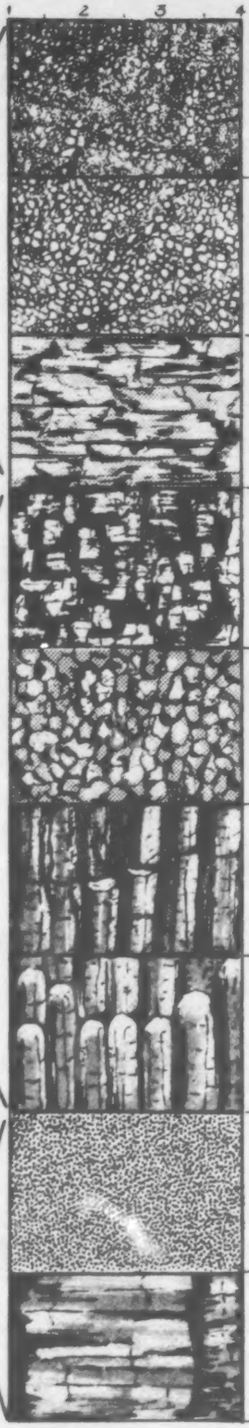
Intake rate - The rate the water enters the soil

Soil properties control root penetration of plants. Usually soil characteristics vary with the lay of the land. The depth and layering of soils will affect root growth and will determine the irrigation practices to use for maximum plant growth without wasting water.

UNIT: Irrigation
TOPIC: Importance of Irrigation
(Information Sheet continued)

The most ideal condition for all stages of vegetative growth is the proper temperature, permeable soil, adequate moisture, accessible plant food, and adequate light. Most crops should be irrigated at different depths due to the growth characteristic of the plant. For example, pasture grasses require an irrigation depth of 1.5 to 3 feet, whereas, alfalfa requires water up to a depth of 8 feet.

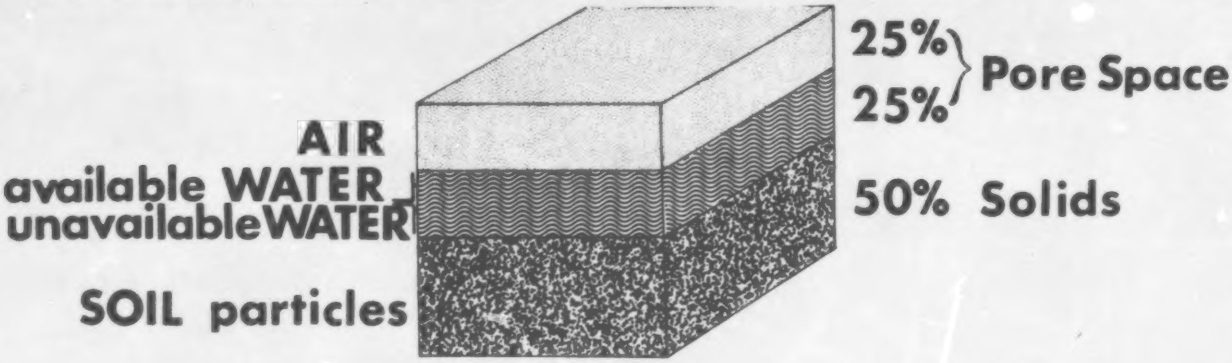
COMMON TYPES OF SOIL STRUCTURE



A Horizon	CRUMB	Aggregates small, porous and weakly held together Fast percolation
	GRANULAR	Aggregates small, non-porous and strongly held together Highly permeable
	PLATY	Aggregates flat and horizontal Plates overlap causing poor permeability
B Horizon	ANGULAR BLOCKY	Aggregates have sides at nearly right angles Moderately permeable
	SUBANGULAR BLOCKY	Aggregates with corners rounded More porous than above
	PRISMATIC	Prism-like with the vertical axis greater than the horizontal
	COLUMNAR	As above except with rounded caps Moderate percolation
C Horizon	SINGLE GRAIN	Soil particles exist as individuals and do not form aggregates Fast percolation
	MASSIVE	Soil materials cling together in large uniform masses Slow percolation

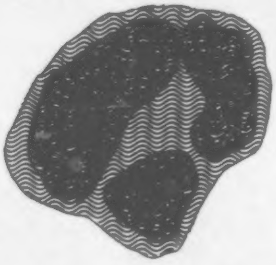
Soil Moisture Storage

A Block of Soil with Ideal Air-Water-Solid Balance


25%
25%
Pore Space
AIR
available WATER
unavailable WATER
50% Solids
SOIL particles

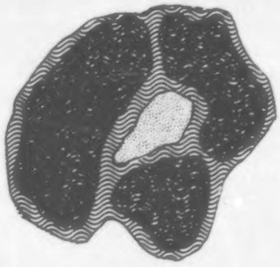
Soil Moisture Conditions

Saturation



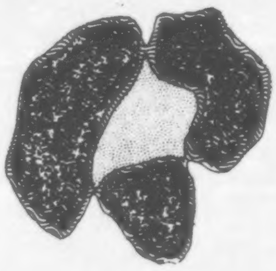
TOO WET
no air space

Field Capacity



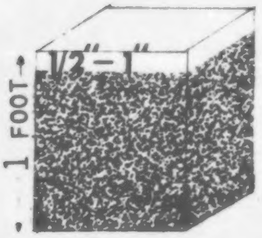
IDEAL
balance between
air-water-soil

Wilting Point

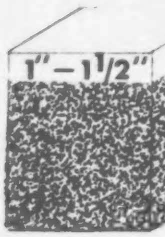


TOO DRY
no available water

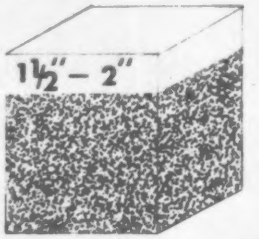
Available Moisture Storage Capacity of Variously Textured Soils



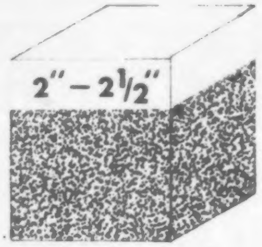
SAND



SANDY LOAM



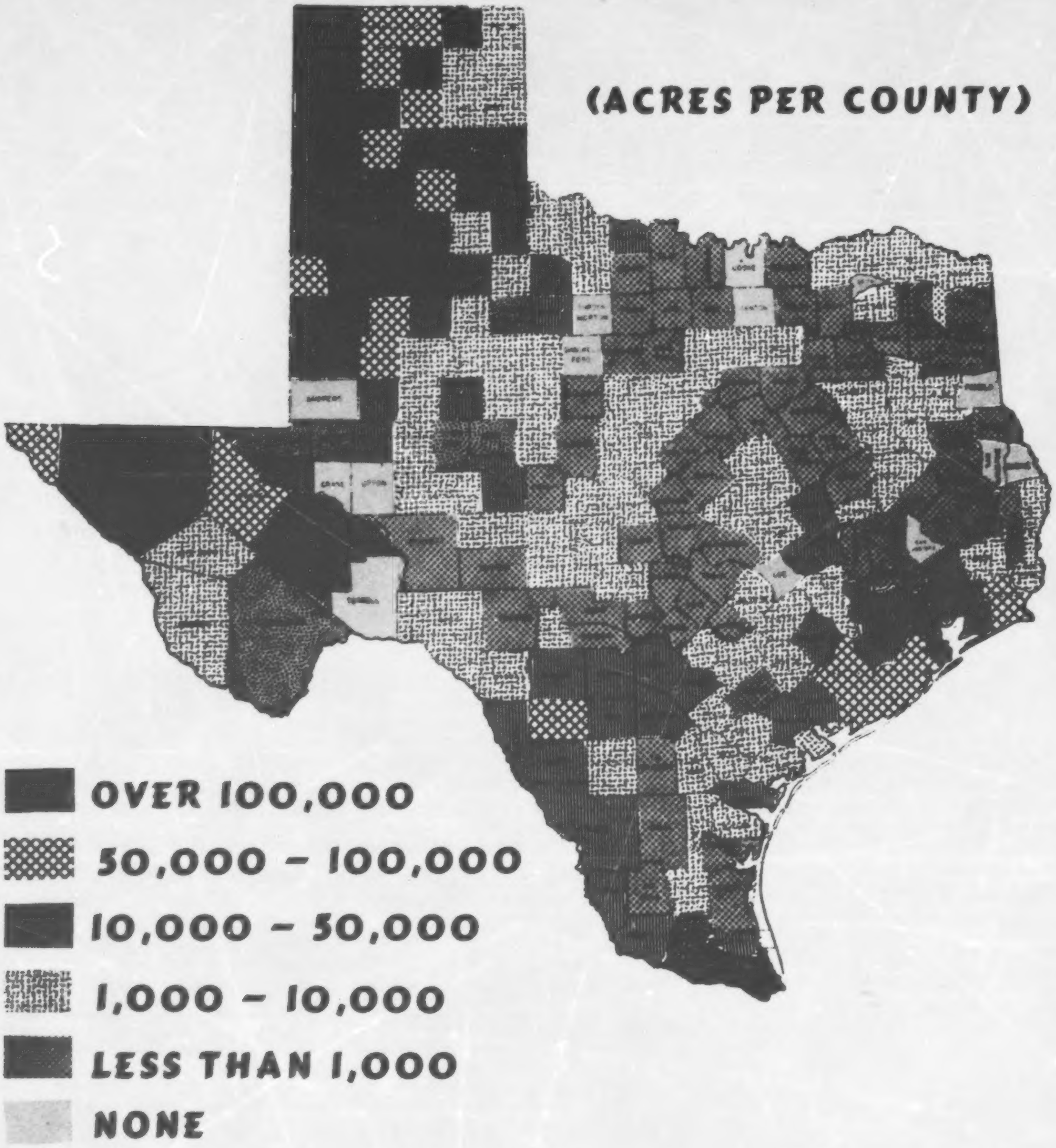
CLAY & SILT LOAM



CLAY

DISTRIBUTION OF IRRIGATED ACREAGE IN TEXAS

(ACRES PER COUNTY)


OVER 100,000
50,000 - 100,000
10,000 - 50,000
1,000 - 10,000
LESS THAN 1,000
NONE

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Irrigation

TOPIC: Sources of Water and Principal Methods of Irrigation

OBJECTIVE: To lead the student to recognize the importance of the sources of water.

REFERENCES:

Required:

1. Our Soils and Their Management, Donahue, pp. 363-390.
2. Information Sheet, "Sources of Water and Principal Methods of Irrigation".

QUESTIONS OR ACTIVITIES:

1. What should be considered in selecting the type of irrigation to be used?
2. Give two sources of irrigation water.
3. What are some advantages of using sprinkler irrigation systems?
4. What type of sprinkler system is used to eliminate the moving of laterals by hand labor?
5. What are the two types of crops that are flood irrigated?
6. What type of crops are irrigated by the border method?
7. Describe the contour-levee and contour-ditch method of irrigation.
8. What percent of slop should be used when irrigating by the furrow method?
9. Why do light, sandy soils require a type of irrigation management practice different from heavy soils?
10. Define the corrugated method of irrigation and the areas where it is used.
11. What are some advantages of using subirrigation methods?
12. Explain the main source of water supply.

Information Sheet
on
SOURCES OF WATER AND PRINCIPAL METHODS OF IRRIGATION

Overhead Irrigation Methods

Sprinkler irrigation systems distribute water by spraying it over the fields. The water is piped to the fields under pressure which forces the water through sprinklers, perforations, or nozzles in pipelines, thus forming a spray.

Nearly all irrigable soil can be sprinkler irrigated. This is the best method to use on soils which have high intake rates, on fields with steep slopes or irregular topography, and on soils too shallow to level.

Sprinkler irrigation is a versatile means of applying water to any crop. Water can be applied at rates equal to, greater than, or less than the infiltration rate of the soil. It can be completely automatic or can be manually operated.

Sprinkler systems have uses other than meeting the water needs, such as fertilizer application, frost protection, and temperature control.

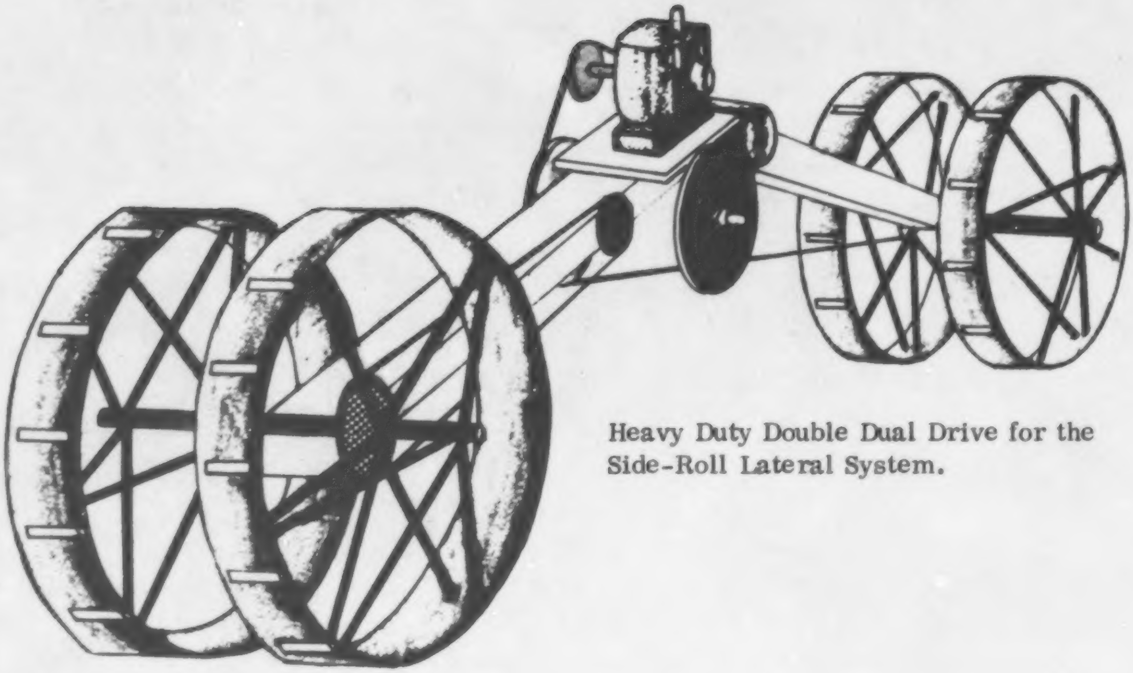
There are many types of sprinkler systems. All may be generally classified as (a) portable, (b) semiportable, and (c) stationary or solid set.

The portable and semiportable systems are most commonly used. A fully portable system has either a stationary or a portable pump and portable main lines, laterals, and sprinklers. The semiportable system usually has a stationary or a portable pump and portable main lines, laterals, and sprinklers. In a solid-set system the entire field is served simultaneously by lateral lines. The main and laterals can be either located on the ground surface or buried.

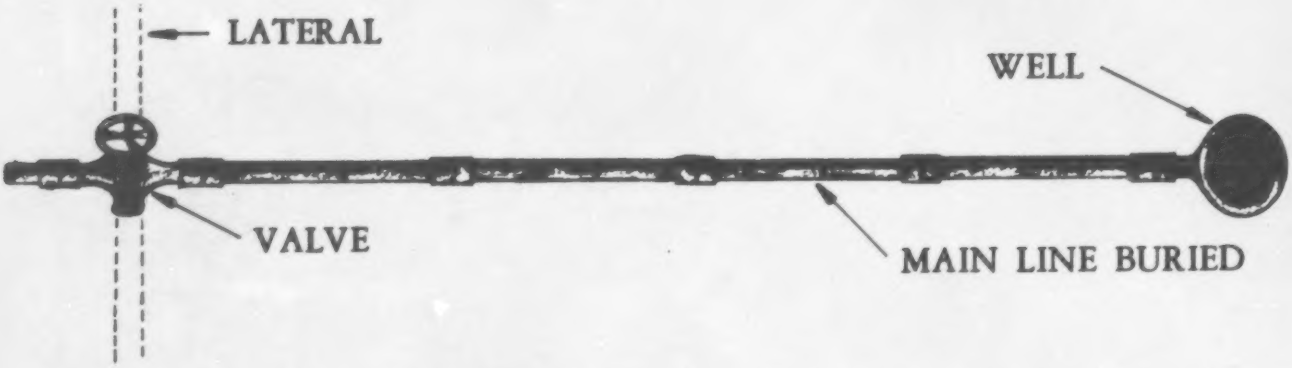
Stationary systems are those in which the main pipelines, laterals, and sprinklers are fixed permanently throughout the entire area to be irrigated. Combination systems with stationary pipelines and portable sprinklers are frequently used on parks and golf courses.

Portable and semiportable systems can also be classified according to the method of moving the laterals. A common method is the hand move method in which the laterals are carried by hand in 20 to 40 feet sections of pipe to the next lateral position, usually a distance of 40 to 80 feet. There are also various types of mechanical move systems designed to reduce the labor cost of moving pipe. In the side-roll lateral system, the lateral pipe acts as an axle of large wheels which are spaced 30 to 40 feet apart. A small internal combustion engine mounted at the midpoint of the line is used to roll the lateral to the next position. This is illustrated on Page 3.

Mobile Sprinkler Unit

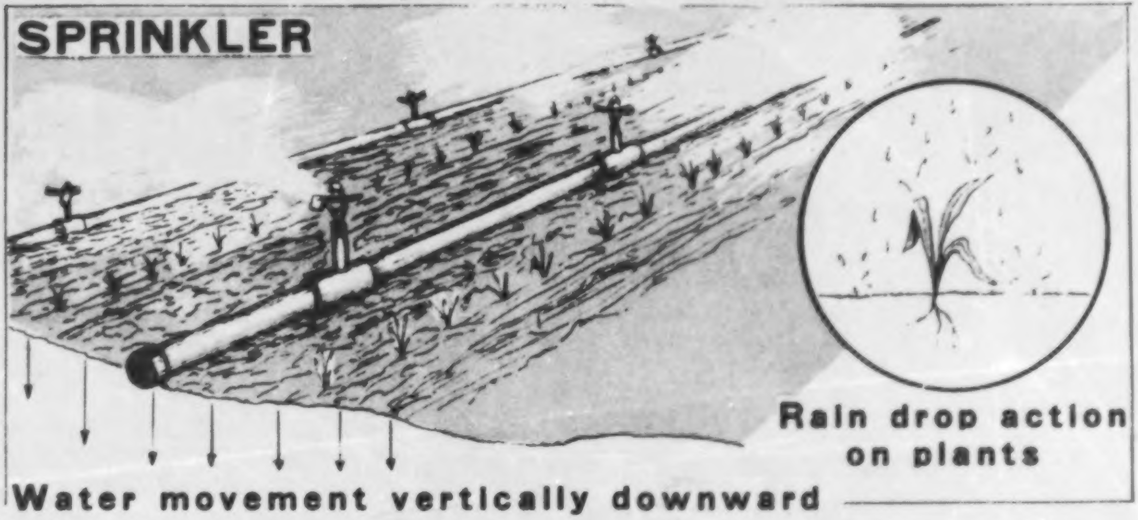


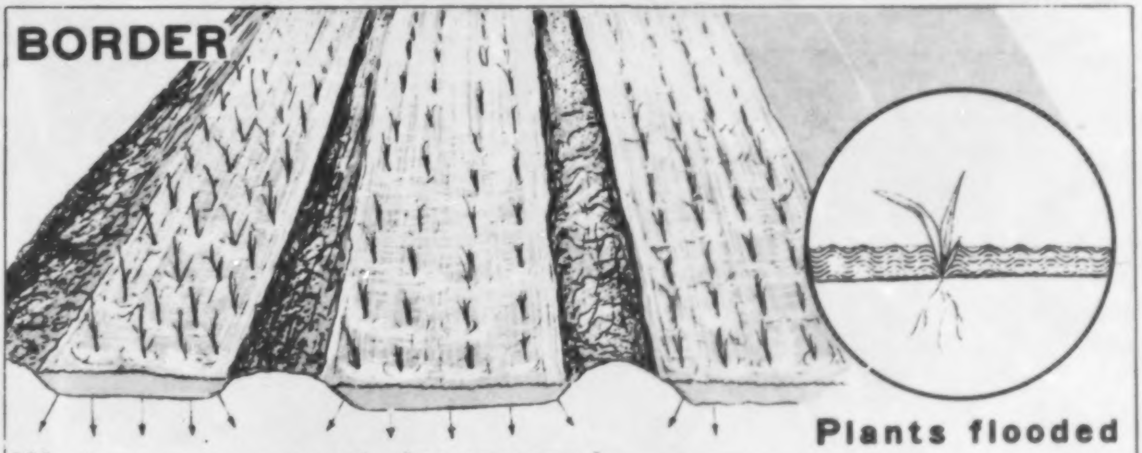
Heavy Duty Double Dual Drive for the Side-Roll Lateral System.

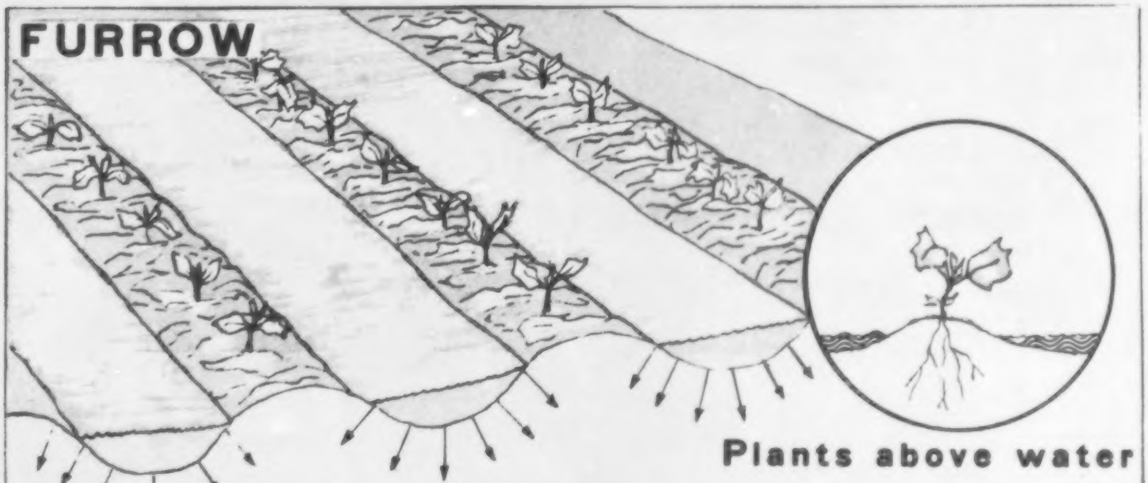


There are various types of end pull systems in which the laterals are moved to a new position by pulling one end with a tractor. Various types of wheels or skids are mounted to the lateral.

Irrigation Methods


SPRINKLER
Rain drop action on plants
Water movement vertically downward


BORDER
Plants flooded
Water movement downward


FURROW
Plants above water
Water movement downward and outward

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Information Sheet continued)

A self-propelled sprinkler system consists of the lateral pipeline supported at a height of six to eight feet at intervals of about 100 feet on towers mounted on two wheels. The lateral line is rotated slowly around a pivot point in the center of the field by either water pressure actuators, or electric motors at each tower. The sprinklers distribute water to the field as the pipeline is moving. Systems are available to cover square fields of 24 to 260 acres. An oscillating sprinkler that swings back and forth in an arc is located on the end of the boom extension to catch the corners of a square field so that only a negligible area is missed when irrigating fields are set up on a square pattern.

Giant sprinkler or boom type systems have only one boom sprinkler on each lateral which is mounted on a stand or trailer and moved by towing the stand or trailer to the next position. Each sprinkler has one to eight or more nozzles. Areas covered by the spray vary from one to five acres per set. Giant sprinkler systems are not recommended for areas having high winds.

The trail line or hydro move system is like pulling a blanket across the fields. The lateral line is carried across the field on towers or wheels. As it moves, it is followed by a 120 feet telescoping main line. The entire unit is powered by a reciprocating water motor using the same water that irrigates the crop. When the line has moved 120 feet, it can be disconnected, collapsed, and reconnected in ten minutes for another 120 feet extension. The normal set is 120 feet in ten to twelve hours.

A master control switch is provided (usually at the pump) to protect the entire self-propelled system against unforeseen emergencies. Should any obstruction prevent the safe operation of the assembly, the safety control stops the system immediately. A time-delay relay also stops the engine or electric motor drive at the pump, thereby completely shutting down the system in a few seconds or minutes as desired. A horn, blinking light, or other warning device can also be connected with the shut-off control to insure prompt attention to the system, night or day, so that prescheduled watering systems are not delayed.

Surface Irrigation

Water is applied directly to the soil surface either by controlled flooding or in some kind of furrow. In controlled flooding the water applied to the surface is controlled by dikes and ditches. Graded-border, level-border, and contour-ditch methods are different types of controlled-flooding irrigation. In the furrow method, water is applied through regularly spaced large furrows, furrows between crop rows, or closely spaced small furrows or corrugations. In general, flooding methods are used for close-growing crops and furrow methods for row crops.

Graded-Border Method

DESCRIPTION

Graded-border irrigation is a form of controlled surface flooding. The field to be irrigated is divided into strips by parallel dikes or border ridges, and each strip is irrigated independently. The border strips should have little or no cross slope but should have some slope in the direction of irrigation. Each strip is irrigated by turning in a stream of water at the upper end. The stream must be large enough to spread over the entire width between the border ridges without overtopping them. Usually the stream size should be such that the desired volume of water is applied to the strip in a time equal to or slightly less than that needed for the soil to absorb the net amount required.

ADAPTABILITY

This method is suitable for irrigating all close-growing, non-cultivated, sown or drilled crops (except rice) and any other crops grown in ponded water. Legumes, grasses, small grains, and mint are commonly irrigated by this method. Graded-borders are also used for irrigating orchards and vineyards.

Graded-border irrigation can be used on most soils. It is best suited to soils which have a moderately low to moderately high intake rate. Usually it is not used for coarse, sandy soils with a very high intake rate because of the stringent limitations on design. Nor is it well suited to soils having a very low intake rate, since, to provide adequate intake time without excessive surface runoff, the irrigating stream may be too small to completely cover the border strips. This method is best suited to slopes of less than 0.5 percent. If erosion from rainfall is not a hazard, it can be used successfully on steeper slopes if the soil intake rate is not too low. For non-sodforming crops, this method is seldom used on slopes of more than two percent, but it can be used on slopes as steep as four percent for sod crops. In humid areas the maximum slope to be irrigated by this method is about two percent for sodfarming grasses and 0.5 percent for other crops.

Level-Border (Basin) Method

DESCRIPTION

This method is based on the rapid application of irrigation water to a level, or nearly level, area enclosed by dikes which retain the water at a uniform depth until it has been taken into the soil. Level-borders are similar to basins, but basins generally are square and level borders are several times longer than they are wide.

An overall fall of 0.2 foot in the length of the border strip is often desirable as construction tolerance to avoid reverse grades. The stream of water turned into each border should be at least twice that required for the average intake rate of the soil. If the border is level, the irrigation stream can be turned in at any point or points around the border and at both ends if desired. If the border has a slight grade, the irrigation stream is applied at the upper end.

ADAPTABILITY

This method is best suited to soils having a moderate to slow intake rate (2.0 intake family or less) and a moderate to high available water holding capacity. Although an efficient system for water application can be designed for soils with a higher intake rate and a lower available water holding capacity, the borders are so small they interfere with cultural practices and the location of delivery laterals.

Smooth, gentle, uniform land slopes are best suited to this method and give the best field layouts. One major advantage of this method is that it can be used to irrigate many different kinds of crops regardless of planting pattern. Crops which are adversely affected by flooding, such as carrots, can be planted in beds and irrigated with light applications in the intervening furrows. Row crops less susceptible to flooding can be flat-planted or bedded. Sown crops, drilled crops, and sod crops can be irrigated by using border furrows to guide the water. These wide variations can be accomplished without basic changes in layout or rate of application and still maintain high efficiency.

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Information Sheet continued)

Contour-Levee Method

DESCRIPTION

This method is a modification of the contour-border or basin method. Areas bounded by small contour levees and cross levees are completely flooded. Water applied at a rate considerably in excess of the intake rate of the soil spreads rapidly over the area and is allowed to remain until it has infiltrated the soil to the desired depth. If the irrigation is for soil-moisture replenishment, the excess water is then drained off immediately. If the irrigation is for weed control on riceland, the water is impounded at a minimum depth of three inches and a maximum depth of eight inches or less for several weeks.

Size of the unit area depends on the size of the available irrigation stream, soil intake characteristics, and topography of the field. Generally, a stream of one cubic foot per second is required for each two acres for rapid flooding. Drainage is provided by placing pipe culverts in the drainage-ways through each levee. Water is held at the desired level by small weir-type spillways in the levees, allowing excess water from one area to spill over into the area immediately below.

Contour-Ditch Method

DESCRIPTION

Contour-ditch irrigation is a form of controlled surface flooding. Irrigation water is distributed from ditches running across the slope approximately on the contour. Water is diverted from the ditches by temporary dams. As the water rises, it is discharged through controlled openings in the ditch bank, by siphon tubes, or over a uniformly graded lower lip of the ditch. Water flows as an unconfined sheet down the slope from one contour ditch to the next, and runoff is collected in lower ditches for reuse. Water is applied to successive strips between ditches until the field has been irrigated. The width covered by each setting of the dams depends on the stream size available. A stream of one cubic foot per second usually covers a strip about 100 feet wide. The spacing between contour ditches (80 to 300 feet) is governed by topography, soil intake rate, and average net irrigation application.

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Information Sheet continued)

Graded-Furrow Method

DESCRIPTION

Grade furrows are small channels having a continuous fall, sloping uniformly in the direction of irrigation. They are used in irrigating cultivated crops planted in rows. There are one or more furrows between crop rows except for bedded crops, in which the furrows are along each pair of rows. Size and shape of the furrows depend on the crop grown, equipment used, and spacing between crop rows. Water flowing in the furrows soaks into the soil and spreads laterally to irrigate the areas between furrows. The length of time needed for water to be run in the furrows depends on the amount of water required to refill the root zone, intake rate of the soil, and rate of lateral spread of water in the soil. For most soils, the initial irrigating streams must greatly exceed the intake rate in order for the water to advance rapidly. Therefore, when water reaches the lower end of the run, the streams must be adjusted or cut back to prevent excessive waste from surface runoff. Otherwise, provisions must be made to recover tail water. But for low-intake-rate soils that crack when dry, it is usually unnecessary to cut back the streams.

ADAPTABILITY

The graded-furrow method can be used to irrigate all cultivated crops planted in rows, including orchard and vineyard crops, as well as all field and truck crops. Graded furrows can be used on all soils except sands having a very high intake rate which provide very poor lateral distribution of water between furrows. Graded furrows must be used with extreme care on soils with high concentrations of soluble salts. To avoid excessive amounts of toxic salts accumulating in the areas between furrows, some surface-flooding method may be necessary to leach salts from the root zone before the graded furrow method can be used successfully.

This method is best suited to sites where the furrow method does not exceed one percent. However, in areas where erosion from rainfall is not a problem, the grade can be as much as three percent. If an area has intense rainfall, the furrow grade may need to be reduced 0.5 percent or less to minimize the erosion hazard. On smooth, uniformly sloping fields, crops can be planted across the slope to reduce the furrow grade. Furrows are also used on graded benches built across the slope.

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Information Sheet continued)

IMPORTANT FEATURES

Both large and small irrigating streams can be used by adjusting the number of furrows irrigated at any one time to fit the available flow. Therefore any method for delivering water, from continuous flow to full demand, can be used. Field efficiency is high if water management is good. In areas where surface drainage is necessary, the furrows can be used to rapidly dispose of runoff from rainfall.

Contour-Furrow Method

DESCRIPTION

The contour-furrow method is similar to the graded-furrow method in that irrigation water is applied by furrows, but the nearly level furrows carry water across a sloping field rather than down slopes. The contour furrows are curved to fit the land surface. They have just enough grade to carry the irrigation stream. Head ditches or pipelines are run downhill or slightly across the slope to feed the individual furrows.

ADAPTABILITY

This method can be used on most sloping soils except light sandy soils and soils that crack. The ridges between furrows in sandy soils may break and wash out, overloading the furrow below, which also breaks. This may continue all the way down the slope, causing heavy erosion damage. Soils that crack provide channels for water, causing similar downslope furrow breaks. This method is particularly suited to fields of uniform slope in both directions because most of the furrows can run completely across the slope and there need be few point rows.

The contour-furrow method can be used for nearly all cultivated crops planted in rows. In arid sections deep-furrowed row crops which are grown on medium and fine-textured soils can be irrigated, if the slope does not exceed six percent. On light-textured soils, the slope must not exceed four percent because of the danger of furrow breaks. For shallow-furrowed crops, the slope must not exceed three percent. For citrus and deciduous fruits, cane, berries, vineyards, and nut trees, the slope can be steeper since the furrows are not disturbed by cultivation.

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Information Sheet continued)

Level-Furrow Method

DESCRIPTION

Level furrows are small channels without grade formed by farm equipment and used to irrigate crops planted in or between the furrows. The level-furrow method of water application requires the rapid introduction of irrigation water. A stream which fills the furrow is turned into the furrow until the gross application has been made. The water, which is at uniform depth throughout the furrows, stands until absorbed by the soil. Lateral or capillary movement of water through the soil distributes the water to areas between furrows.

ADAPTABILITY

The level-furrow method is best suited to soils having a moderate to slow intake rate (2.0 intake family or less) and a moderate to high available water holding capacity. The best field layouts for level furrows are on smooth uniform slopes. Row crops are the crops most easily irrigated by level furrows, but drilled or sown crops can be irrigated effectively if the soil has been furrowed and ridged before planting. In areas where rainstorms occur in such intensity and duration that the water-storage capacity of the furrow may be exceeded, border dikes are also needed.

IMPORTANT FEATURES

If this method is properly designed and operated, the amount of water applied can be adjusted to meet seasonal variations by simply changing duration of application or size of efficiency. No irrigation water need be lost through runoff. Unless winds of high velocity affect the advancing stream, the field ditches or other conveyance structures can be spaced at twice the design furrows length since water can be introduced at both ends of the furrows. This reduces cost of constructing and maintaining the delivery system, and farm machinery can travel farther before turning. Maximum use can be made of rainfall even if storm intensity exceeds the intake rate. Provisions for disposal or reuse of tail water are not needed. Leaching can be easily accomplished. This method can be automated easily.

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Information Sheet continued)

Level-Furrow Irrigation

Corrugation Method

DESCRIPTION

Corrugation irrigation is a partial surface flooding method. Irrigation water does not cover the entire field but is applied in small channels or corrugations evenly spaced across the field. Water flowing in the corrugations soaks into the soil and spreads laterally to irrigate the areas between corrugations. The corrugations should be spaced to permit an adequate lateral spread by the time the desired amount of water has infiltrated the soil.

The length of time necessary for the water to run in the corrugations depends on the amount of water required to refill the root zone and on the intake rate of the soil. Initial irrigating streams must greatly exceed the intake rate of the soil in order to advance rapidly. Therefore, when water reaches the lower end of the run, the streams must be adjusted or cut back to prevent excessive waste from surface runoff or provisions must be made to recover tail water.

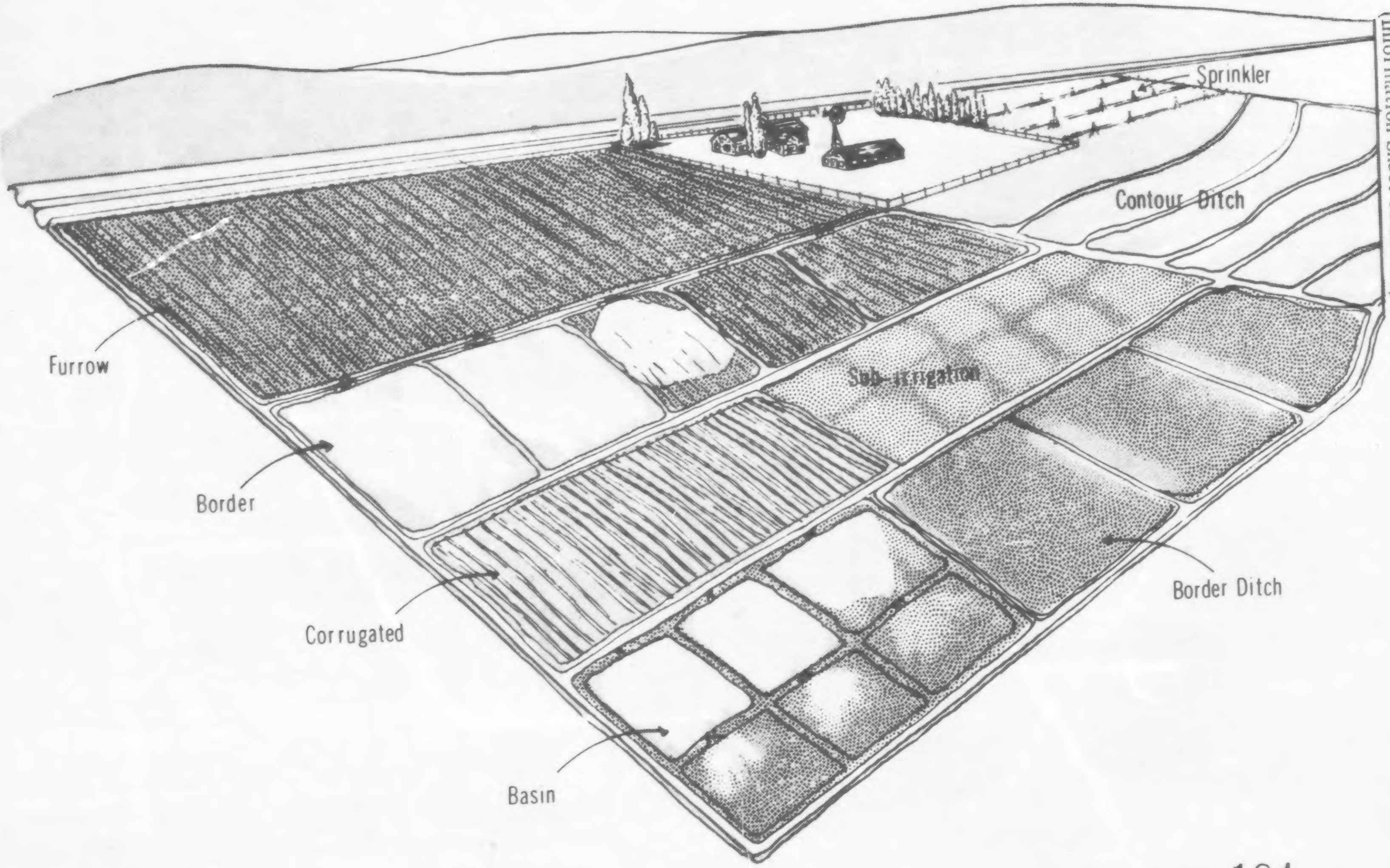
ADAPTABILITY

Corrugation irrigation is best suited to areas of low rainfall and smooth fields which slope between one and eight percent. It can be used on irregularly sloping sites, but the corrugations must have a continuous slope in the direction of irrigation and the cross slope must be such that breakthroughs from both irrigation water and rainfall runoff are held to a minimum. The cross slope should usually be considerably less than the slope in the direction of irrigation. The use of corrugations in humid areas usually creates a serious erosion hazard.

All close-growing, non-cultivated sown or drilled crops, except rice and other crops grown in ponded water, can be irrigated by this method. Legumes, grasses, and small grains are commonly irrigated by this method as well as non-cultivated orchards and vineyards having grass or legume cover crops.

Corrugations are best used on fine to moderately coarse textured soils. They are not suitable for coarse-textured, high-intake-rate soils or saline soils. The method is especially good for irrigating soils that bake or crust.

Types of Irrigation


Sprinkler
Contour Ditch
Furrow
Sub-irrigation
Border
Border Ditch
Corrugated
Basin

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Information Sheet continued)

Subirrigation Method

DESCRIPTION

Irrigation water is introduced through open ditches or tile drains. The water table is maintained at some predetermined depth below the ground surface, usually 12 to 24 inches, depending on the rooting characteristics of the crop grown.

Open ditches are probably most widely used. Feeder ditches are excavated on the contour and spaced close enough to insure control of the water table. They are connected to a supply ditch that runs down the predominant field slope and has control structures as needed to maintain the desired water level in the feeder ditches.

ADAPTABILITY

The subirrigation method is suited to soils having reasonably uniform texture and permeable enough for water to move rapidly both horizontally and vertically within and for some distance below the crop's root zone. The soil profile must also contain a barrier against excessive losses through deep percolation, either a nearly impermeable layer in the substratum or a naturally high water table on which a perched or artificial water table can be maintained throughout the growing season. Topography must be smooth and almost level or the slopes should be very gentle and uniform. The subirrigation method is suited to irrigating vegetables, most field crops, small grains, pasture grasses, most forage crops, and flowers.

This method can be used for soils having a low water-holding capacity and a high intake rate where surface methods cannot be used and the cost of sprinklers is excessive. The water level can be maintained at optimum depths for crop needs at different growth stages. Water loss by evaporation from the soil can be held to a minimum. Weed seeds are not carried over the surface by irrigation water.

The subirrigation distribution system can also be used for drainage. Tile feeder lines generally provide better drainage than open-ditch feeder lines. Less labor is required than for any other irrigation method. Labor is required only for regulating stream flow into the system, regulating water-level control structures, and tending the pump if pumping is required.

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Information Sheet continued)

Since this method requires an unusual combination of natural conditions, it can be used in only a few areas. Water having a high salt content cannot be used. In some arid areas, soils become saline unless adequately drained. Choice of crops is limited in some areas. Deep-rooted crops such as deciduous orchard trees and citrus trees generally cannot be subirrigated.

Sources and Supply of Water

Perennial streams were one of the first sources of water supply for irrigation. Since 1930, dams have been constructed on the streams, thus supplying adequate water for irrigation without having to depend on rainfall.

Reservoirs and lakes impound water from drainage areas to irrigate a limited acreage. Reservoir and lake water is limited due to the following factors:

1. Water requirements of crops to be irrigated
2. Application efficiency of the irrigation system
3. Losses due to evaporation and seepage
4. The amount of rainfall and water held in storage

Ground water from deep or shallow wells is the main source of water supply in areas where water is not available from abundant rainfall or the soil is not suitable for storage areas. Deep wells are usually the most dependable source of water. In areas where it is available, surface water is the principal source of water for irrigation. This is supplied by water diverted or pumped from streams; water released from lakes or reservoirs directly into a farm irrigation system; water pumped from lakes, reservoirs, and canals or obtained from other surface sources.

Water from streams is generally the cheapest source of water for irrigation. A perennial stream is a dependable source as long as the acreage to be irrigated needs no more water than the stream produces during drought periods. If the acreage to be irrigated requires more water than the dry-weather flow, the water must be impounded to insure an adequate source. Smaller perennial streams and intermittent streams are not dependable sources unless their water can be impounded. Unless a stream is large enough that an adequate supply is obvious, it is necessary to determine the dependable dry-weather flow. The U. S.

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Information Sheet continued)

Geological Survey or some other federal or state agency may have gauged the stream and, if so, can furnish data for determining its dependability. If not, it is necessary to measure the flow during a prolonged dry period.

Water is stored in natural lakes or surface reservoirs, ranging from small impounding or excavated farm ponds to large impounding mainstream reservoirs. Large reservoirs are built to furnish water to a group or groups of farmers through some kind of legal organization, such as an irrigation district or conservation district. Small farm ponds are usually built for use on single farms.

The watershed yield for an impounding irrigation reservoir must be high enough to provide the necessary supply during years of low yield. A study of rainfall and runoff records or stream gauging may be necessary to determine this yield. In addition to capacity for storing the gross irrigation-water requirements, allowance must be made for loss of water by evaporation and seepage and capacity loss through filtration.

Natural lakes are a good source of irrigation water, but withdrawal of water for irrigation is often restricted. More and more of our natural lakes are being developed for recreation and residential use, and everything is being done to maintain lake levels. Several factors influence whether the farmer has use of a lake as a dependable source of irrigation water. These include the size of the lake, whether the farmer's land completely surrounds it, or whether he has a legal right to use the water.

Land Water Management - Quality of Water

Crop production under irrigation is influenced by the quality of water used, because this affects the irrigation and drainage practices to be followed which determines the type of crops that can be grown successfully.

All water from surface streams and underground sources contains dissolved substances known chemically as salts. Ocean water contains approximately 3 percent salts. Water used for irrigation generally contains less than 0.5 percent salt.

In common usage, salt is thought of as table salt. However, thousands of different salts are known. Some of the examples of the salts in irrigation water are table salt (sodium chloride), Epsom Salt (magnesium sulfate), gypsum (calcium sulfate), muriate of potash (potassium chloride) and baking soda (sodium bicarbonate).

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Irrigation

TOPIC: Irrigation Management

OBJECTIVE: To lead the student to realize that there is more to irrigation than simply putting water on the land.

REFERENCES:
Required:
1. Our Soils and Their Management, Donahue, pp. 363-389.
2. Information Sheet, "Irrigation Management".

QUESTIONS OR ACTIVITIES:

1. Why is land preparation important in surface irrigation?
2. What are the steps in irrigation?
3. What is "good" irrigation water?
4. Give the number of inches and locations of the lowest and highest rainfall areas in Texas.
5. At what period is water critical for the following crops:
    a. Small grain
    b. Cotton
    c. Corn
    d. Peanuts
    e. Perennial grasses
    f. Rice
    g. Citrus fruit
6. How much water will cotton use during the critical demand period?
7. What is the purpose of irrigating a crop?
8. How can the moisture be measured by feel in sandy clay loam soil?
9. When should all crop land be irrigated?
10. Where is the greatest amount of soil moisture used by the plant?
11. List the fixed costs in an irrigation program.
12. What is the estimated useful life of the following types of irrigation power systems? Electric motor, diesel, and gasoline.

Information Sheet
on
IRRIGATION MANAGEMENT

Land Preparation

It is essential for lands of each irrigated farm to be well-prepared for irrigation. This special land preparation is called land leveling or grading. Land leveling for irrigation is nothing more than modifying the surface of a field to a planned grade to provide a more suitable surface for efficiently applying irrigation water. Normally, land leveling requires moving a lot of soil from one locality to another, usually accomplished with special equipment, such as a land plane or carry-all scraper.

The job of land leveling will be influenced by the soil type, slope, climate, crops to be grown, and methods of irrigation. When a specific field is to be leveled, the actual leveling project should not be initiated until the farmer knows the soil profile of the land and how deep he can make a maximum cut (depth) without reducing the land's potential agricultural production. The climate of an area sometimes places certain limits on slope in order to prevent erosion from rainfall, but generally these are minor in Class I and II soils. The crops to be grown affect the irrigation methods to be used, as well as the amount of leveling needed. Intensively cultivated crops, such as vegetables, justify a high leveling cost, whereas a hay crop in an area with a short growing season may warrant a smaller investment.

Many equipment companies make machines which level the land so that water may be applied more economically.

Equipment

Modern farm implements are playing a major role in irrigation farming.

Implements such as dirt buggies or soil movers, graders, land planes, reversible plows, disc harrows, ditcher blades, border machines, bed shapers, and precision planters are making it possible to speed up the farming operations and cut expenses of irrigation.

Border machines used in the Rio Grande Valley of Texas are usually purchased from a dealer. Most ditcher blades operating in Texas are tractor-mounted and are used to form ditches with steep banks which are high enough to carry a large head of water.

UNIT: Irrigation
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(Information Sheet continued)

Equipment is needed to remove debris from most sprinkler systems if water is obtained from streams. When water is pumped from wells, this equipment is not needed. The system must be kept clear of sand, weed seeds, leaves, sticks, moss, and other trash that may plug the sprinklers.

Weather Conditions

Weather is one of the most important factors in crop production. It may determine completely, or in part, the species of crops to be grown as well as the yields and quality of crops produced.

Weather may be generally defined as the day-to-day status of the atmosphere as it relates to the physical changes on the earth's surface. Among many atmospheric factors used to describe the weather are temperature, relative humidity, rainfall, solar radiation, and air movements.

Climate may be generally defined as the weather condition of the area over a long period of time.

Adequate soil moisture is needed if man is to make the most efficient use of the soil in the production of crops and livestock.

In Texas the average annual rainfall ranges from 8 inches in the extreme west to 58 inches in the southeastern part as shown on the rainfall map of Texas.

Rainfall is defined as any form of precipitation (rain, snow, sleet, hail) which measures .01 inches or more.

Very few locations in Texas have adequate rainfall to meet the requirements necessary to attain maximum production. The lack of normal rainfall results in irrigation in arid regions.

There may be an area with a good average annual rainfall and yet not have sufficient moisture during a great part of the growing season. Every area has its wet and dry years.

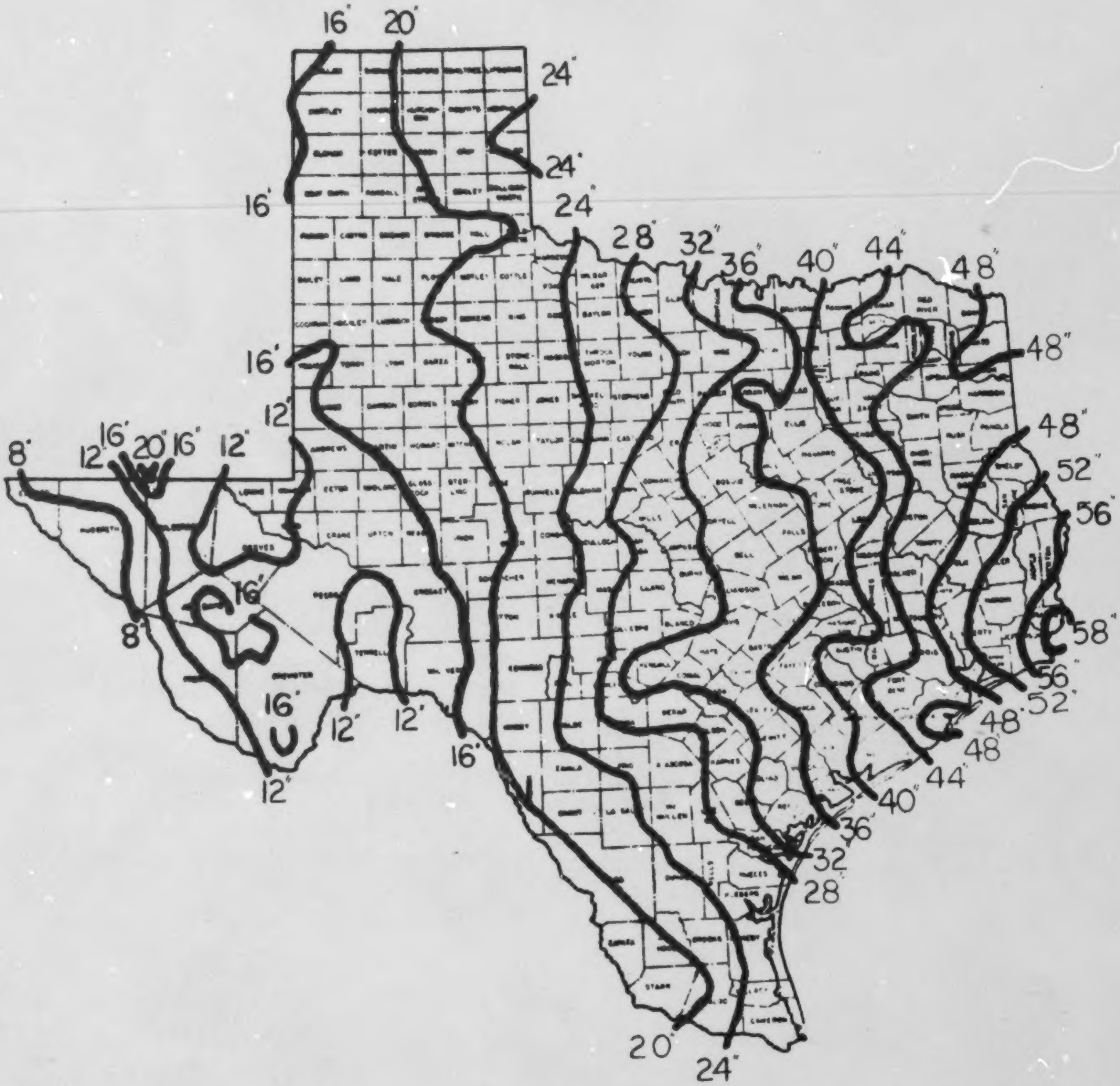
Irrigation systems must be planned to provide for expected frequencies of drought periods. There is no uniformity in the rainfall of a given area; it is continually changing. In one area of Texas during a ten year period, the annual rainfall has been as low as 12 and as high as 50 inches.

UNIT: Irrigation
(Information Sheet continued)

WATER REQUIREMENTS OF TEXAS CROPS

Crop[1]	Critical water demand periods[2]	Approximate water use inches per day[3]	Water requirement inches[4]
Cotton	Bloom stage until about 1/2 to 3/4 of bolls are mature	0.25 to 0.40	15-26
Corn	Tasseling-silk stage until grain becomes firm	0.20 to 0.28 0.28 to 0.38	8-12 humid 15-22 semi-arid
Grain sorghum	Boot, bloom & milk-dough stage	0.25 to 0.40	16-20
Wheat-spring	Boot, bloom & early head stages	0.22 to 0.35	14-22
Tomatoes	Bloom & fruit enlargement period	0.25 - 0.35	12-18
Lettuce & cabbage	Head formation until they become firm	0.17 - 0.20	7-12
Irish potatoes	Tuber swelling period at bloom to harvest	0.16 - 0.20	12-15
Carrots	When root enlargement & swelling starts	0.15 - 0.19	8-10
Onions	Bulb formation to maturity	0.15 - 0.20	10-12
Alfalfa	Bloom and seed forming	0.27 - 0.40	30-50
Soybeans	Bloom and seed formation	0.25 - 0.35	22-26
Castor beans	Bloom stage to physiological maturity	0.33 - 0.40	25-30
Peanuts	Prior to and during time nuts start to form	0.22 - 0.25	6-12
Perennial grasses	Seed head formation	0.25 - 0.35	25-35
Legumes	Bloom & seed forming-summer	0.22 - 0.33	15-24
winter	Bloom & seed forming-winter	0.13 - 0.19	12-16
Rice	Head formation & filling	0.25 - 0.30	35-45
Peaches	Fruit setting & fruit swelling	0.22 - 0.26	22-30
Orange and grapefruit	Fruit setting & enlargement stages	0.25 - 0.35	30-40

RAINFALL BELTS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40"
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32
28
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20"
24"

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TOPIC: Irrigation Management
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1. The crops listed are only a cross-section of the different ones grown throughout the state.
2. Periods are based on the stage of growth in which a lack of soil moisture would probably be most detrimental to yield or quality or both.
3. Daily evapo-transpiration rate (approximate). These are expected average maximum daily water use values for the individual crops. Generally, the periods of maximum water use for most crops will be during the bloom and fruiting stages of growth. In some cases it may extend about half through the maturing stage. Because of the wide variation in climate, soils, crops, varieties, and planting dates throughout Texas, these values are somewhat general. More precise values for the individually irrigated areas can be found in the irrigation frequency guides which follow in this section.
4. The water requirement values shown are the extremes which can usually be expected. The smaller values apply to the more humid regions, while the larger values are to be applied to the semi-arid regions of Texas. Where saline soils and water are encountered, the requirement will be increased 20 to 50 percent and even more in such areas as the Trans-Pecos.

Rainfall Distribution

The amount of rain which falls in a given area varies considerably from year to year. Between 1912-1956 at Spur, Texas, the greatest amount of rain which fell was 42.87 inches in 1941 and the lowest was recorded in 1956 with 6.87 inches.

The value of rainfall to farmers and ranchers depends on the nature and amount of the rain (and farming and ranching methods). The main features in the nature of rain are (1) the time interval between rains and (2) the intensity of rainfall. In some sections of Texas, the interval between rains is too long to be able to grow crops of maximum yield. Rains of two inches or more at a time are best for building up soil moisture to grow crops. In 44 years at Spur, there were only 105 rainfall periods which produced two inches or more of rain. A "rainfall period" is a sequence of days with all having a measurable amount of rainfall.

In 38 years at Chillicothe, Texas, there were only 104 rainfall periods which brought two inches of rain or more. On the average, this is a fraction more than two rainfall periods a year.

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During the critical water demand period of crops, cotton will use 15 to 26 inches of water, corn will use 15 to 22 inches in the semi-arid areas, and grain sorghum will use 16 to 20 inches. This is shown on the "Warm Season Rainfall Map in Texas" on the next page.

The warm-season rainfall map shows the average summer rainfall in Texas. In East Texas, rainfall is usually sufficient for producing commonly grown crops. In some areas of the state, it is sufficient for producing crops only during certain seasons. In the west and south, irrigation is necessary for most types of crop production.

The effectiveness of summer rainfall on crop production results chiefly from frequency, intensity, duration, and seasonal distribution. Much of Texas summer rainfall occurs in high intensity, torrential thunder showers; therefore, much is lost in runoff.

Estimation of Soil Moisture by Feel

Irrigation is a means of maintaining a continuous supply of available moisture in the soil's plant root zone throughout the growing season. Do not allow soil moisture to reach the wilting percentage, because plants wilt permanently and growth is restricted.

Several days may be required to cover the entire acreage; therefore, start irrigation soon enough to reach the last portion of the field before its available moisture has been exhausted.

Regular inspection of soil moisture conditions at several depths provides information about the amount of available moisture in the soil and the root depth of plants. This gives a basis for determining when to irrigate and how much water to apply. For most crops, irrigation should be started when 50 percent of the available moisture in the soil root zone has been used.

A practical method of estimating available soil moisture is to squeeze a small amount of soil to form a ball. If the available water-holding capacity of soil is known, one can determine the amount of water to apply by irrigation.

Estimating soil moisture by feel and appearance is not a precise measuring method. However, this method is effective if results are observed carefully. For example,

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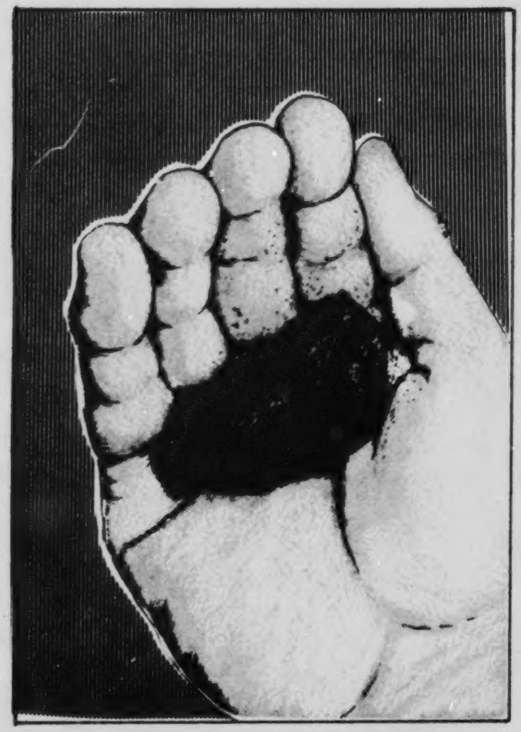
a sandy clay loam soil which contains an average of 50 percent available moisture in the root zone depth of 3 feet should hold 2.0 inches of available moisture per foot of soil, or a total of 6.0 inches in the root zone at field capacity. If available moisture remaining is estimated at 50 percent, apply 3 inches of irrigation water.

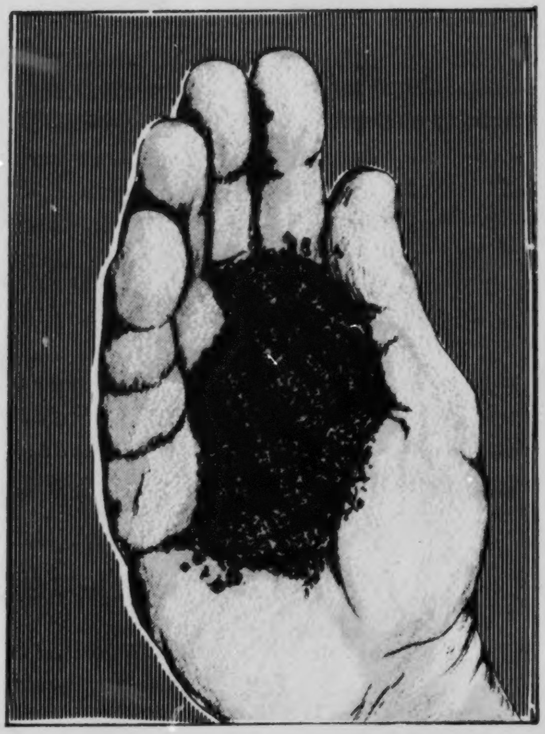
Depth of water penetration into soil can be determined a day or two after irrigation by using a soil probe. (A probe can be made of a 1/2 inch steel rod 4 or 5 feet long with a short piece of 3/4 inch pipe welded on one end to serve as a handle.) Although a soil probe is easy to use, a sharpshooter shovel or post-hole digger can also be used to determine the water penetration depth. Water should have penetrated 3 feet. If penetration depth is more or less than 3 feet, adjust the irrigation schedule or the amount of water applied.

Soil Samples Taken From 1 Foot Depth:

Needs No Irrigation & Needs Irrigation



Moist Sandy Clay Loam Soil



Dry Sandy Clay Loam Soil

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When to Irrigate - Critical Periods

Periods when adequate soil moisture is very important are:

All crops	Prior to planting
Melons	Blossom to harvest
Pasture	After grazing
Orchard	Fruit development

Determining when to Irrigate by Crop Appearance

Root crops wilt temporarily during the hottest part of the day when they need water.

Alfalfa changes to a dark green color when there is a lack of moisture.

Grain crops wilt during the hottest part of the day if there is a need for water.

Fruit crops indicate a need for water by a wilted appearance of the leaves. Fruit growth may be retarded if observing the leaves is the only method used for determining moisture needs. Continuous soil moisture tests will insure good production, if used to judge how much water to irrigate.

Determining when to Irrigate by Estimating Soil Moisture

Soil moisture content can be measured by tensiometers, electrical conductance meters, moisture counting (calculating by daily inventory the water remaining in the soil) or the "feel" test.

When using the feel and appearance test, a soil sample is taken by using a shovel, soil auger, or tube. A handful of soil that has been squeezed very firmly will form a ball in the palm of the hand if adequate moisture is available. The soil sample should be taken from a depth of one foot.

If clay loam is estimated to average 50 percent available moisture in a root zone three feet deep, and the soil is estimated to hold 2.0 inches of moisture per foot, or a total of 6.0 inches in the root zone at field capacity, then 3.0 inches of water should be added when 50 percent of the moisture is still available.

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A test to determine the depth of water penetration into the soil may be made a day or two after irrigation; water should have penetrated three feet. If the penetration depth is more, or less than three feet, the irrigation schedule should be adjusted to give the proper depth of moisture penetration.

Irrigation to Improve Crop Stands and Improve Quality

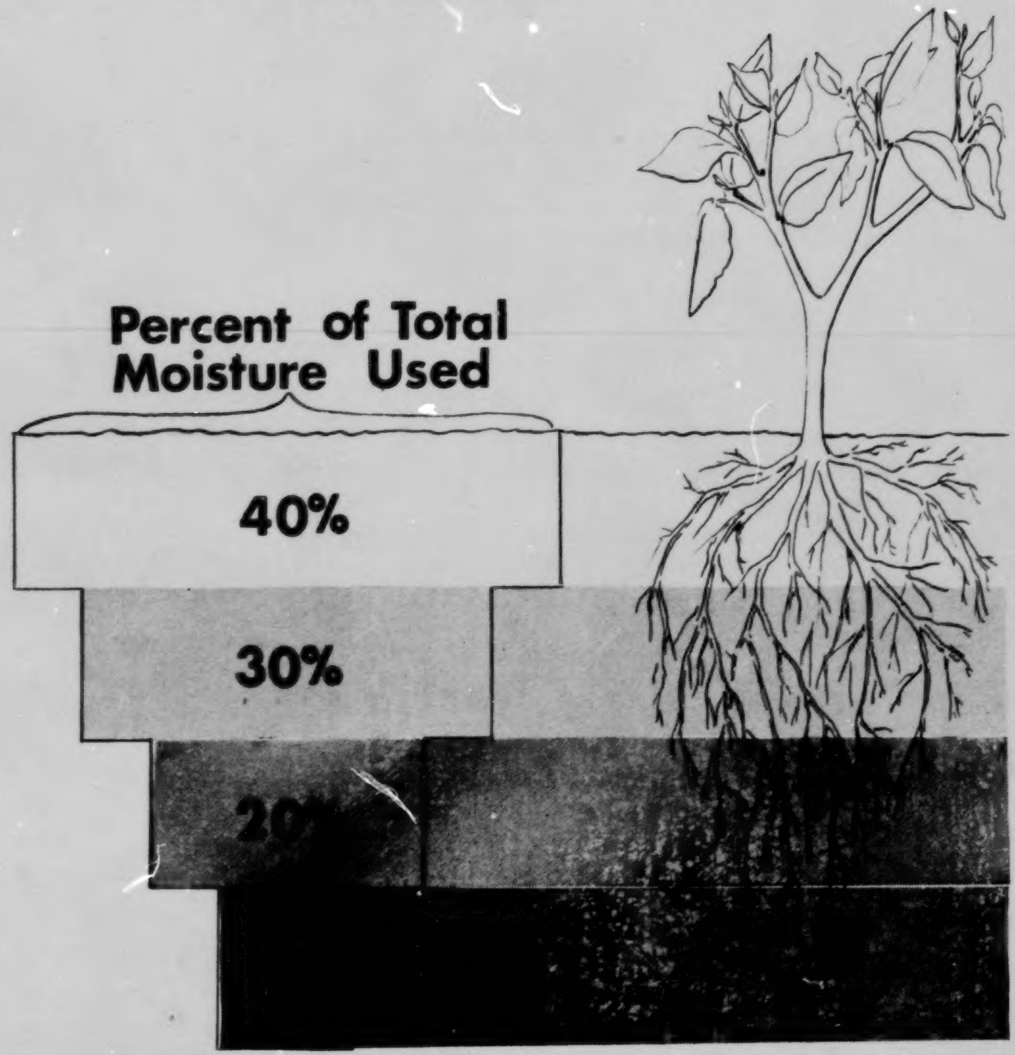
High production depends upon a good stand or adequate plant population per line or foot of row. After the seedbed is prepared for planting, the soil moisture must be sufficient to germinate the seed.

Young seedlings require a large amount of top soil moisture for the initial stages of root development. As the different crop plants mature, the soil must be wetted to the depth that the root will likely penetrate. Listed below are penetration depths of several mature plants:

Irrigated Grass Pastures	1.5 feet to 3 feet
Potatoes	2.0 feet to 4 feet
Beans	2.5 feet to 4 feet
Small Grains	3.0 feet to 5 feet
Corn	4.0 feet to 5 feet
Sugar Beets	3.5 feet to 5 feet
Alfalfa	4.0 feet to 8 feet

It is important that the soil contains adequate moisture throughout the root zone, even though the plant may get as much as 40 percent of the available moisture from the top one fourth of the root zone depth. For example, if a potato root penetrates the soil 4.0 feet, 40 percent of the moisture used by the plant will come from the first foot of soil.

Percent of Moisture Used by Plant in Root Zone


Percent of Total Moisture Used
40%
30%
20%

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GUIDE FOR JUDGING HOW MUCH MOISTURE IS AVAILABLE FOR CROPS

Available Soil Moisture Remaining	Feel or Appearance of Soil			
	Coarse Texture	Moderately Coarse Texture	Medium Texture	Fine & Very Fine Texture
0 to 25 percent	Dry, loose, single-grained, flows through fingers.	Dry, loose, flows through fingers.	Powdery dry, sometimes slightly crusted, but easily broken down into powdery condition.	Hard, baked, cracked, sometimes has loose crumbs on surface.
25 to 50 percent	Appears to be dry, will not form a ball with pressure.[1]	Appears to be dry, will not form a ball.[1]	Somewhat crumbly, but holds together from pressure.	Somewhat pliable ribbons out be-pressure.[1]
50 to 75 percent	Appears to be dry, will not form a ball with pressure.	Tends to ball under pressure but seldom holds together.	Forms a ball, somewhat plastic, will sometimes slick slightly with pressure.	Forms a ball, ribbons out between thumb and forefinger.
75 percent to field capacity (100 percent)	Tends to stick together slightly, sometimes forms a very weak ball under pressure.	Forms weak ball breaks easily, will not stick.	Forms a ball, is very pliable, slicks readily if high in clay.	Easily ribbons out between fingers, has slick feeling.
At field capacity (100 percent)	Upon squeezing, no free water appears on the soil, but wet outline of ball is left on the hand.	Upon squeezing, no free water appears on the soil, but wet outline of ball is left on the hand.	Upon squeezing, no free water appears on the soil, but wet outline is left on the hand.	Upon squeezing, no free water appears on the soil, but wet outline of ball is left on the hand.

[1] Ball is formed by squeezing a handful of soil very firmly.

Type and Cost of Power

GENERAL

The engineer may be called upon to compare costs of different types of pumping installations, particularly the use of different kinds of power units. It may also be necessary to determine pumping costs in figuring the economics of irrigation. The purpose here will be to point out all factors to be considered in computing the cost of pumping water at the outlet of the pump.

It is impossible to give actual costs of pumping-plant installations that will be applicable to all field conditions. Close estimates of equipment and construction costs may be prepared by consultation with manufacturers and review of past installations so that the actual pumping costs will be within the limits anticipated.

Cost of pumping includes all fixed and operating costs. Fixed costs include all costs for which an initial outlay is made or a capital investment is extended, including taxes and insurance. Annual operating charges include all recurring costs.

FIXED COSTS

1. Interest. Calculated at the prevailing interest rate on the average value of the installation.

   Annual interest cost=

   $$\frac{\text{Value of installation}}{2} \times \text{interest rate}$$

2. Taxes and insurance. This item varies from one area to another. Use actual rates if available. For preliminary estimates, such costs are usually assumed to total about one percent of the initial cost of the installation.

3. Depreciation. Depreciation should be based on either time of operation or age. In areas where pumps are operated almost continuously, the year around hours of operation should be used. Age is a satisfactory method for determining depreciation where pumps are used less than 2,000 hours per season. Table 8-3 of depreciation figures, based on work at the University of Nebraska, can be used in figuring depreciation:

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(Information Sheet continued)

Table 8-3. — Pumping Plant Depreciation

Item	Estimated useful life
Well and casing	20 years
Plant housing	20 years
Pump turbine:	
Bowl (about 50 percent of cost of pump unit)	16,000 hours or 8 years
Column, etc.	32,000 hours or 16 years
Pump, centrifugal	32,000 hours or 16 years
Power transmission:	
Gear head	30,000 hours or 15 years
V-belt	6,000 hours or 3 years
Flat-belt, rubber and fabric	10,000 hours or 5 years
Flat-belt, leather	20,000 hours or 10 years
Electric motor	50,000 hours or 25 years
Diesel engine	28,000 hours or 14 years
Gasoline or distillate engine:	
Air-cooled	8,000 hours or 4 years
Water-cooled	18,000 hours or 9 years
Propane engine	28,000 hours or 14 years

OPERATING COSTS

The annual operating cost of a system will include fuel, oil, repair and maintenance of all the equipment, reservoir and field maintenance, extra labor, additional fertilizer, seed, land preparation, and harvesting due to the increase in yield.

Annual fuel cost may be determined on the Bhp-hours (power delivered by crankshaft in feet $\frac{\text{pounds per minute}}{33{,}000} = \text{Bhp}$) per unit of fuel. It may be shown as follows:

Fuel and Power	Bhp-Hours
Electric	1.03 to 1.18 per kw. hr.

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Diesel	14.6 per gallon
Propane	9.2 per gallon
Gasoline	11.5 per gallon
Natural Gas	8.9 per 100 cu. ft.

In order to determine the total cost, the horsepower required is multiplied by the total number of hours operated and this figure is multiplied by the cost per unit of fuel. The total is then divided by the Bhp hours per unit of fuel.

Example of operating a diesel engine:

110 horsepower required
362 hours of operating time in year
0.40 cost of fuel per gallon
14.6 Bhp hours per unit of fuel

$110 \times 362 \times .40 \div 14.6 = \$1,090.96$

These figures do not represent the actual fuel cost of operating an engine of this size one year, but it serves as an example in determining the cost of five different types of power units. Gasoline, propane, and high-speed diesel cost may also be determined by using the following method:

Type of engine	Fuel consumed Gallons/h.p. - hr.
Gasoline (air-cooled)	1/8
Gasoline (water cooled)	1/10
Propane	1/7
High-speed diesel	1/12

Fuel consumption of the propane engine probably has the greatest variance because the compression ratio has a marked effect on rate of fuel consumption. Engines with higher compression ratios consume less fuel. Any engine in poor repair may exceed the ratio given. The load imposed on the engine is an important factor in fuel consumption. Fuel cost will go up if the throttle setting of the engine is increased beyond the manufacturer's recommendation.

(Cost per hour of operation) = b. hp. x (Fuel consumed in gallons per h. p. hour) x cost of fuel per gal.

Total annual fuel cost = Cost per hour x total hours operated.

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Fuel consumption of natural gas engines vary with the B. T. U. content of the gas. For estimating purposes, it can be assumed that 10 cubic feet of gas are required for each horsepower-hour of operation.

Usually a manufacturer's fuel consumption curve is available to make a close estimate of the fuel consumption.

Lubricating oil is considered negligible for electric driven plants, but it is a known cost for gasoline, diesel, and propane plants. A close estimate may be made by using the following information:

Lubricating oil		Grease per hr. of operation
Gasoline engine	1 gal. per 1,000 hp. - hrs.	$0.02
Diesel	1 gal. per 1,000 hp. - hrs.	.02
LPG and natural gas	0.3 gal. per 1,000 hp. - hrs.	.02

Engine maintenance and repairs are continuing to be more costly each year. Repair costs are difficult to estimate since they tend to increase with the age of the equipment. The amount of the repairs jobs is largely affected by the total hours of operation. When accurate costs are not available, the following method may be used to estimate repair and maintenance costs:

Electric Motors	$4.00/year w. hp.
Gasoline and distillate	$ .00275 per w. hp. - hrs.
Diesel	$ .0039 w. hp. - hrs.

Pump Maintenance and Repairs

Turbine: $\text{Yearly cost} = \dfrac{\text{One-half total cost}}{\text{Estimated life in years}}$

Centrifugal: $\text{Yearly cost} = \dfrac{\text{Total cost}}{\text{Estimated life in years}}$

Shelter maintenance may be figured $5.00 per year.

Attendance of system + percent of plant operation time x the prevailing wage rate is another added cost. The percent of plant-operation time varies according to the type of installation as follows:

Diesels with large storage tank, electric or natural gas - 3 percent

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Gasoline or distillage plants permanently mounted - 5 percent
Movable installations - 10 percent

In Summary:

$$\text{Cost per acre} = \frac{\text{Total yearly cost}}{\text{Acres irrigated}}$$

$$\text{Total yearly cost} = {}^{*}\,\text{Fixed cost} + \text{operating cost}$$

$$\text{Operating cost per acre foot} = \frac{\text{Operating cost}}{\text{Acre feet of water pumped}}$$

$$\text{Cost per acre - foot of lift} = \frac{\text{Cost per acre - foot}}{\text{Feet of pumping lift}}$$

*Fixed costs include interest, taxes and insurance, and depreciation.

Annual fixed costs depend entirely upon the amount of initial investment. In attempting to reduce these fixed costs, it is usually not a sound policy to purchase equipment which is smaller than needed or of low quality. A smaller pumping plant will have to operate over a longer period of time in order to pump the required amount of water. The fixed costs of using the smaller plant would be reduced. The operating costs, however, may be increased in greater proportion. A plant of greater initial cost may be sufficiently more economical in fuel and repairs and thereby warrant the higher fixed costs.

A cost study is the only way to obtain the information necessary to arrive at the best selection. A combination of fixed and operating costs which results in the lowest over-all costs will generally be the best selection of the type and size of pumping plant.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Weed Control

TOPIC: Importance of Weed Control

OBJECTIVE: To lead the student to realize the direct and indirect financial losses caused by the lack of weed control.

REFERENCES:
Required:
1. Information Sheet, "Importance of Weed Control".
2. "Controlling Weeds", VAS 4042, Illinois.

QUESTIONS OR ACTIVITIES:

1. What is a weed?
2. Why do we have herbicide laws?
3. How do weeds cause an indirect loss to the farmer?
4. How do weeds cause a direct loss to the farmer?
5. What is meant by H. B. 402, when referring to herbicide laws?
6. How are the various counties in Texas affected by House Bill 402?
7. What does the term applier mean?
8. What U. S. agency works with the United States Department of Agriculture in regulating the use of pesticides?

Information Sheet
on
IMPORTANCE OF WEED CONTROL

The Weed As An Early Plant

Early man domesticated plants with about the same purpose in mind as domesticating animals. Plants were selected and cared for to serve man, because they were first used to supply food in the form of fruits and nuts. Primitive man used plants in a limited way for clothing and shelter.

At the same time certain plants were being domesticated, undesirable plants flourished within the domesticated plant environment. Non-useful plants grew among the early tame plants and were often poisonous, harmful, non-nutritious, very prolific, competitive, and difficult to destroy. These characteristics of weeds in early times are the same characteristics of weeds today. While early man was domesticating plants and animals, weeds were known as "plants out of place". The weed is still recognized as a plant growing where it is not wanted.

How Weeds Cause Losses

In the United States, the annual economic loss in crop production due to weeds is estimated at approximately $4 billion. This does not include the cost of measures to control weeds. Insects and diseases do not cause as great a loss to crop industry as that caused by weeds.

Crop yields are reduced by weeds.

Weeds compete with crop plants for moisture, plant nutrients, and light.

Many weeds require more water than cultivated plants.

Perennial weeds rob the deep-rooted crop plants of moisture and nutrients.

Plants require a certain amount of space in order to grow and produce fruit. Where plants are grown under crowded conditions, the growth and fruit production will be abnormally low.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

Weeds lower the quality of plant and animal products.

The quality of hay is reduced if large quantities of weeds are present.

Crop products such as grain are sold at a reduced price if weed seeds are present.

Wool and mohair brings a lower price if it contains burs, stickers, and weed trash.

Weeds may affect the odor and taste of mild cheese, butter, and eggs. Off-flavored milks may be rejected by the manufacturer.

Weeds such as wild garlic will cause wheat to be of low quality due to the flavor and odor.

Weeds increase production costs.

An infestation of weeds increases the cost of preparing a seedbed, planting, cultivating, and harvesting a crop. Extra labor and equipment are required to control weeds.

It is necessary to separate weed seeds from grain in order to meet certain law and grade requirements.

Weeds reduce land values.

Land highly infested with hard-to-control weeds is not purchased as readily as land infested with easily controlled weeds.

The price of land may be reduced if it is infested with weeds that are difficult to destroy.

Weeds harbor insects and diseases.

Weeds serve as a habitat for insects during the winter season. Many insects feed and reproduce on weeds in the same manner as they do on crop plants. A large number of weeds serve as food for the insect until crop plants become available. Also, they may serve as a host plant after the crop plants are harvested.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

Some weeds affect livestock and people.

There are many poisonous plants in native pastures that cause an annual loss of several million dollars in the livestock industry.

Pollen from various weeds cause hayfever and respiratory problems. All people are not allergic to the same type of weed pollen.

Direct contact with certain kinds of weeds causes serious skin irritations. Such weeds are poison ivy, poison sumac, nettles, and a variety of other poisonous plants.

HERBICIDE REGULATION NO. 1-E

This Regulation repeals and replaces all prior Herbicide Regulations and amendments to the regulations

WHEREAS, The Commissioner of Agriculture of the State of Texas has been directed by H. B. 402, Acts 53rd Leg., Regular Session, to promulgate regulations governing the sale and use of hormone-type herbicides, and

WHEREAS, there is a need to rewrite Herbicide Regulation No. 1-D to incorporate certain amendments herein pertaining to applications of herbicide and to exclude certain counties from paragraph A of Section I.

SECTION I. COUNTIES REGULATED BY H. B. 402.

A. All persons in the counties of Anderson, Aransas, Austin, Bell, Bexar, Brazos, Burleson, Calhoun, Camp, Collin, Collingsworth, Colorado, Cooke, Culberson, Dallas, Delta, Denton, DeWitt, Dickens, Donley, El Paso, Falls, Fannin, Franklin, Freestone, Galveston, Goliad, Gonzales, Grayson, Gregg, Grimes, Guadalupe, Hardin, Hays, Hopkins, Houston, Hudspeth, Hunt, Jack, Jackson, Jasper, Jefferson, Karnes, Kaufman, Knox, Lamar, Lamb, Lavaca, Lee, Leon, Limestone, Loving, Lynn, McLennan, Madison, Martin, Midland, Milam, Morris, Nacogdoches, Newton, Orange, Palo Pinto, Parker, Parmer, Rains, Red River, Reeves, Refugio, Robertson, Rockwall, San Patricio, Tarrant, Titus, Travis, Tyler, Van Zandt, Victoria, Waller, Ward, Washington, Williamson, Wise, Wood, must comply with all requirements of the Texas Herbicide Law and these regulations, in sale and use of hormone-type herbicides; provided, however, that in counties of Guadalupe, Gonzales, Karnes, Goliad, DeWitt, Jackson, Victoria, Refugio, San Patricio, Aransas and Calhoun no permit or permit fees are required for spraying of hormone-type herbicides during the months of January and February.

B. In the county of Fayette the use of high volatile esters of hormone-type herbicide is hereby prohibited and aerial applications of other hormone herbicides must be made under supervision of a representative of the Texas Department of Agriculture.

In Houston, Delta and Lamar Counties aerial application of hormone-type herbicides is hereby prohibited.

No bond or permit will be required for making applications of hormone-type herbicide with ground equipment in Karnes County.

Further, in the counties of Bell, Milam, Williamson and Falls application of hormone-type herbicides as defoliants may be made without restriction during the period August 25th to November 30th of each year, except in Williamson County which will be from August 25th to October 31st of each year.

C. H. B. 402 and this regulation apply to the following counties: Chambers, Harris, Fort Bend, Brazoria, Wharton and Matagorda with these additional special provisions.

1. The sale and use of high volatility herbicides is prohibited in all of these counties.
2. The application of 2, 4-D by aircraft, ground equipment or any means in all of these counties (Liberty, Chambers, Harris, Fort Bend, Brazoria, Wharton and Matagorda) is hereby prohibited unless, prior to such use, approval of the Commissioner of Agriculture or his representative is secured, but in no case shall 2, 4-D be used to treat any area that is nearer than two (2) miles to any growing crop.
3. Every custom application of herbicides in these counties, although covered by a blanket permit, must be approved personally by a representative of the Texas Department of Agriculture at the beginning of such application.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

4. Aerial application of herbicides is hereby prohibited in the following areas of the county named below, or described area; In the area beginning at Dayton, thence north along Hwy 321 to Luce Bayou, then west along Luce Bayou to the Harris County Line, then south along Harris County Line to Hwy 90 then east along Hwy 90 to Dayton, aerial application of herbicide is prohibited except in cases where area to be treated is at least one mile from growing crop. Prior approval of each application of hormone-type herbicide in this area must be given by the Commissioner or his representative.

5. No bond or permit will be required in the use of ground equipment in the application of hormone-type herbicides during the period of December 1 to the following April 15 of each year in Dickens County.

6. In Brazoria, Fort Bend and Matagorda Counties the application of 2, 4-D or any derivative thereof, by any method, is hereby prohibited during the period beginning March 25th and ending September 1 of each year; except that special permits may be issued for ground equipment use. The use of ester formulations of hormone-type herbicides by any means is prohibited during the period specified in preceding sentence.

7. In that portion of Wharton County lying west of the Colorado River the application of 2, 4-D or any derivative thereof, by any method is prohibited during the period beginning March 10 and ending October 1 of each year.

8. In San Patricio County no bond or permit is required during the period beginning September 1 and ending March 1 of each year. Application during the period of March 1 through August 31 must be in compliance with Herbicide Regulation 1-E and H. B. 402. Only Amine type herbicides can be used and approval from the Commissioner or his representative must be obtained before application by aerial or ground. Only boom-type ground equipment can be used, nozzle height not to exceed 24 inches, maximum pressure not to exceed 20 lbs. per square inch. Bond or insurance will be required of commercial applicators. Permits and permit fees will be required on all spraying over 10 acres. Only Amine type herbicides will be used and will meet the following requirements:

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

WIND VELOCITY	DOWNWIND	UPWIND
0-5 M. P. H.	Within 16 Rows	8 Rows
6-10 M. P. H.	1/8 Mile	8 Rows

SECTION II. DEFINITIONS: As used in these regulations, the following terms shall have the respective meaning set forth below.

A. The term "Commissioner" means the Commissioner of Agriculture of the State of Texas, his duly appointed agents, employees, and representatives.

B. The term "herbicide" means 2, 4-Dichlorophenoxyacetic Acid (2, 4-D) 2, 4, 5-Trichlorophenoxyacetic Acid (2, 4, 5-T), 2-Methyl-4-chlorophenoxyacetic Acid (MCP), 2, 4, 5-Trichlorophenoxypropionic Acity (silvex), Polychlorinated benzoic acids, and their derivatives and formulations, and such other substances used for weed control as the Commissioner shall from time to time determine after public hearing to prevent a hazard to desirable vegetation through drift or other uncontrolled application.

C. The term "weed" means any plant growing where not wanted.

D. The term "person" means any individual, firm, partnership, association, corporation, company, joint stock association, or body politic, or any organized group of persons whether incorporated or not; any includes any trustee, receiver, assignee, or other similar representative thereof.

E. The term "dealer" means any person who sells, offers or exposes for sale, exchanges, barters, or gives away any hormone-type herbicides. This specifically includes all manufacturing, distributing, wholesaling, and retailing outlets in this State.

F. The term "applier" means any person applying hormone-type herbicides to any land in this State by aircraft, ground or hand spraying equipment.

G. The term "aircraft equipment" means any machine or device designed for, or adaptable to, use in any contrivance used or designed for navigation of or flight in, the air for the purpose of applying hormone-type herbicides as sprays, aerosols, fogs or other forms.

H. The term "ground equipment" means any machine or device for, or adaptable to, use on land or water for applying hormone-type herbicides as sprays, dusts, aerosols, fogs or other forms. Hand spray equipment is specifically included herein.

I. Dry type herbicides shall be defined as an herbicide of dust or powder form. It shall exclude granular or pelletized herbicide consisting of stable aggregates which will not pass a screen of 48 mesh, prepared by incorporating herbicide with a neutral clay or inert binder, and further providing that only low volatile herbicides shall be formulated in this manner and said herbicides shall be used on lawns and for the control or eradication of aquatic weeds and no application may be made by aircraft. Permits will not be issued for said herbicide for use in water that is to be used for irrigation purposes except during the period of September 15 and March 1 of each year.

J. The term "dense brush barrier" is where the overstory and understory canopies combined occupy more than 75 percent of the total area.

K. A "medium brush barrier" is where the overstory and understory canopies occupy 25 to 75 percent of the total area.

L. The term "sparse brush barrier" is where the overstory canopies combined occupy less than 25 percent of the total area.

SECTION III. GENERAL REQUIREMENTS H. B. 402

A. It shall be the joint responsibility of the applier (or crop owner) and customs applier to supervise the application of herbicides in compliance with the rules and regulations, as set up by the Commissioner of Agriculture.

B. In cases where equipment is leased or rented to another person for the purpose of making custom applications, a notarized statement of agreed responsibility, signed by both the Lessor and Lessee must be filed with the Commissioner prior to use by any other than the person for which the equipment inspection was made. In the absence of such statement, the person having control of the equipment at the time of inspection shall be considered the customs applier.

C. The application of hormone-type herbicides in dust form is prohibited.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

D. Hormone-type herbicides shall not be stored or transported with seed, fertilizer, insecticides or fungicides because of the danger of contamination.

E. Any person who engages or employs an applier to apply herbicides when such an applier is not licensed and bonded is violating the Texas Herbicide Law and these Regulations.

SECTION IV. GENERAL REQUIREMENTS OF THESE REGULATIONS

A. All checks for license and permit fees shall be made payable to the Commissioner of Agriculture.

B. Applications of hormone-type herbicides by brush or mop are hereby exempt from the requirements of obtaining a permit, paying a permit fee and keeping records of such application.

C. Expiration of Permits and Licenses:

1. All permits expire when the acreage for which the permit was granted has been sprayed.

2. All dealers licenses and equipment licenses shall expire on January 1st of each year except those valid licenses that were issued before the effective date of this Act which shall expire the first day of January next following the expiration date of the license.

D. Specification of Equipment:

1. Equipment must be equipped with a screen of fine enough mesh to remove all foreign material from the spray solution, provided however, in lieu of a screen in the equipment all spray may be screened through such a screen before being put into the equipment.

2. Hose and hose connections shall be made of such material and so constructed as to eliminate all possible leakage.

3. A positive cut off valve shall be installed between the tank and the outlets and each outlet shall have a positive cut off valve.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

E. Requirements for Spray Operations: All spraying of hormone-type herbicides must conform to these requirements regardless of whether or not a permit is required.

1. Wind Gauge: An accurate wind gauge shall be at the place of spraying during such spraying.

2. Maximum Velocity: No person shall spray herbicides when the wind velocity exceeds ten (10) miles per hour.

3. Maximum pressure for aircraft equipment: It is unlawful for a person to spray hormone-type herbicides with aircraft equipment at an outlet pressure which exceeds 30 pounds per square inch. As an alternative to the herein listed maximum pressure, the equipment may be so regulated to give not less than a 200 micron size droplet.

4. Maximum pressure for ground equipment: It is unlawful for a person to spray hormone-type herbicides with ground equipment at an outlet pressure which exceeds 40 pounds per square inch. As an alternative to the herein listed maximum pressure, a canopy can be installed over the boom so as to keep spray materials from drifting.

5. Type and Concentration of Herbicides: Spraying with non volatile and low volatile herbicides shall be done only under requirements of the following chart. This chart is based upon the use of a one pound concentration of hormone-type herbicide applied per acre. In the event a higher concentration is sprayed, the proximity to susceptible crops shall increase in such proportions as one pound concentration bears to the distance from susceptible crops set forth in the chart below, i. e., using 1 1/2 lbs. at 3 m. p. h., the distance to susceptible crops must be: downwind 1 1/2 miles and upwind 3/4 mile.

WIND VELOCITY	DOWNWIND	UPWIND
0-3 M. P. H.	1 mile	1/2 mile
4-6 M. P. H.	2 miles	1/8 mile
7-10 M. P. H.	4 miles	250 feet

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

6. High Volatile Herbicides: The spraying of high volatile herbicides is prohibited when there are susceptible crops within a four mile radius of every point from the land to be sprayed.

7. The limitations set forth in Number 5 and Number 6 above may be suspended if the person spraying, or the owner of the land or crop to be sprayed, obtains written permission from all owners of susceptible crops within the area protected by such limitations. They must file a copy of such written permission with the State Department of Agriculture before doing the spraying.

8. Height that spray may be released: All spray shall be released at a height not greater than ten (10) feet above the top of crop, weeds or brush being treated.

SECTION V. DEALERS

A. Sale by retailers, distributors, wholesalers, and manufacturers of herbicides are sales within the terms of the Herbicide Law and require a license before such sales are made.

B. Any dealer selling herbicides in or into any of the counties covered by the Herbicide Law and these regulations must have a Dealer's License regardless of whether or not such seller is located within such counties.

C. In the event a person operates more than one place of business under the same firm name, a separate Dealer's License will not be required for each place of business if the records of all sales of each can be submitted to the Commissioner of Agriculture.

D. All dealers are required to make and retain for a period of two years, a record of all sales of hormone-type herbicides. Such records of each sale shall consist of the following information:

1. Name of the purchaser.
2. Mailing address of the purchaser.
3. The date of the sale or delivery.
4. The amount and kind of herbicide sold
5. The area to which the herbicide is to be applied.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

E. Each licensed dealer shall mail to the Commissioner of Agriculture not later than the fifth day of each month a record of all sales of hormone-type herbicides sold during the prior month. Forms for submitting such records and listing the information to be contained therein shall be furnished the dealers by the Commissioner of Agriculture.

F. Fees for a Dealer's License: All dealers (Persons selling hormone-type herbicides except eight (8) ounces or less) of hormone-type herbicides shall pay a fee of Twenty-five ($25.00) Dollars upon submitting an application for a Dealer's License.

SECTION VI. APPLIERS

A. General Requirements - applicable to both appliers for hire and persons applying hormone-type herbicides to their own land or crops.

1. Hormone-type herbicides shall not be transported over or across country for a distance greater than five (5) miles, in bulk or in any type of distributing or transporting equipment ready for application to land, provided, however, the Commissioner of Agriculture may extend such distance by special permits for special containers or mixing tanks.

2. Spraying equipment shall not be moved for a greater distance than five (5) miles from the place of spraying until such equipment has been cleaned with water.

3. The use of any turbine or blower-type of equipment to spray hormone-type herbicides is prohibited; except as herein provided.

4. Records: Both the applier (whether custom applier or individual applier) must keep the following records for a period of two years.

   a. The name and address of the person or persons in control of the land or crops at the time of spraying.

   b. The name and address of the person and firm making the application of herbicides.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

c. The exact location of the land including county, city, community, distances and directions.

d. Date and time of day of spraying.

e. Velocity and direction of the wind at the time of spraying.

f. Quantity and concentration of the herbicide applied per acre.

g. Total acreage sprayed.

h. Type of crop sprayed.

B. Appliers for Hire:

1. All commercial appliers of hormone-type herbicides will be furnished a map of the State of Texas showing the division of the state into districts and each commercial applier must inform the district office in his district before their operation in said district.

2. Spraying Permits: No person shall apply herbicides as a custom applier to a total of more than ten (10) acres in any one year without first obtaining a permit for such application. A Blanket Permit may be issued to a custom applier and such permit holder must submit to the Commissioner a supplemental report of each herbicide application within seven (7) days following such application.

3. Permit Fees: A permit fee of ten (10¢) cents per acre for acreage intended to be sprayed shall be submitted with an application for a spraying permit.

4. Equipment Registration:

a. Inspection: All ground equipment used to spray herbicides for hire must be inspected each year before the equipment is licensed. All equipment used on any aircraft in the application of herbicides must be inspected every thirty (30) days when installed upon said aircraft and must be inspected before use after reinstallation if a period of more than thirty (30) days has lapsed since the last inspection.

An inspection fee of Ten ($10.00) Dollars for each piece of equipment must be paid upon each inspection.

b. All persons engaged in the application of herbicides for hire must execute a surety bond in the penal sum of Twenty Thousand ($20,000.00) Dollars. This bond is to be increased in the amount of Two Thousand ($2,000.00) Dollars for each piece of equipment used to spray hormone-type herbicides for hire. As an alternative to the bond requirements herein, the custom applier may subscribe for, and hold, a policy of Crop Damage Insurance in the same amount as is required by the bond provisions set forth in this section. The requirements of such Crop Damage Insurance policies shall be prescribed by the Commissioner of Agriculture and the policy approved by the Commissioner. Only bonds on forms furnished by the Department of Agriculture will be approved. All bonds and or insurance must be on file with the Department of Agriculture before equipment will be inspected.

c. Equipment Licenses: All aircraft and ground equipment used to spray herbicides for hire must be licensed by an Inspector of the Department of Agriculture before such equipment is used to spray herbicides. A license will not be issued until the equipment has been inspected and the bonds have been filed with the Department of Agriculture. Equipment license tags must be kept with the equipment at all times that the equipment is used to spray herbicides.

C. Persons spraying their own land or crops.

1. Permits:

a. If a person does not spray a total of more than ten (10) acres during any one year, permits or fees are not required.

b. All persons except those applying to lawns who apply hormone-type herbicides to less than ten (10) acres in any one year must give notice of each operation to the Commissioner of Agriculture prior to such operation.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

2. Permit Fees: A permit fee of ten (10¢) cents per acre must be paid for each acre to be sprayed before a permit for spraying will be issued.

3. Equipment used to spray own land or crops: Ground and hand spray equipment used by a person to spray his own land or crops need not be inspected, bonded or licensed. Aircraft equipment used by a person to spray his own land or crops must be inspected and licensed, but bonds are not required for the equipment or the person.

SECTION VII. SPECIAL REQUIREMENTS FOR MISTBLOWERS

A. Use of the mistblower - specific type spray equipment

Operators of tractor-mounted, trailer-mounted, or other portable mistblowers shall comply with the following requirements in obtaining a permit from the Texas Department of Agriculture for the application of low volatile 2, 4, 5-T herbicides for control of hardwoods in pine-timber stands.

1. Furnish a map, at approximate scale of 2 inches to the mile, of the general area to be sprayed and indicate the following information:
    a. Locate boundaries of proposed spray area indicating number of acres to be sprayed.
    b. Locate boundaries and identify susceptible crop(s) such as cotton, vegetable garden crop by direction and distance within 1 mile of the boundaries of the spray area.
    c. Locate by general direction and distance the nearest community with a post office.
    d. Locate and identify the nearest possible road to the spray area.
2. Indicate the kind, amount, concentration and type of herbicide solution to be sprayed and the proposed period of application.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

3. Indicate the major forest type, principal species to be controlled and the density of each of the overstory and understory canopies.

4. Indicate the type of equipment to be used by outlining the nozzle size, elevation in degrees and height of nozzles above the ground and the pressure on the system (PSI) applying the herbicide solution.

5. Briefly describe past experience, if any, on the use of this equipment in previous control program(s).

B. Application Restrictions:

The following restrictions are minimum for safe application of herbicides with all mistblowers and must be abided by under currect regulations.

1. The mistblowers should be operated at a minimum pounds of pressure to obtain efficient coverage and desired droplet size. Sprayer pressure must not exceed 40 pounds PSI.

2. The wind velocity within the forest stand must not exceed 5 mph measured at or above 6 ft. of ground.

3. The mistblower equipment operator must maintain the following regardless of wind direction:

   a. A dense barrier of a minimum of 800 feet from the edge of the nearest clearing or opening to susceptible crops.

   b. A medium barrier to nearest opening to susceptible crops of 1050 feet.

   c. A sparse barrier of a minimum of 1320 feet to the edge of the nearest opening to susceptible crops.

4. The mistblower operator must observe the limitations and requirements as outlined in foregoing regulations as amended by the Commissioner of Agriculture.

SECTION VIII. PENALTIES

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Information Sheet continued)

A. For violation of Herbicide Law: Any person violating any provision of the Texas Herbicide Law is guilty of a misdemeanor and subject to a fine of not less than One Hundred ($100.00) Dollars nor more than Two Thousand ($2,000.00) Dollars or confined to jail not more than thirty (30) days or given both such fine and jail sentence.

The United States Department of Agriculture and Environmental Protection Agency (EPA) developed "A Guide for Commercial Applicators" and "A Guide for Private Applicators". Both types of applicators had to be certified by October 1977.

Private applicator—Certified applicator who uses or supervises the use of any pesticide classified for restricted use for the purpose of producing any agricultural commodity on the property owned or rented by him or his employer or the property of another person producing any agricultural commodity in trade of personal services.

(NOTE: EPA will classify each use of each pesticide as either general or restricted.)

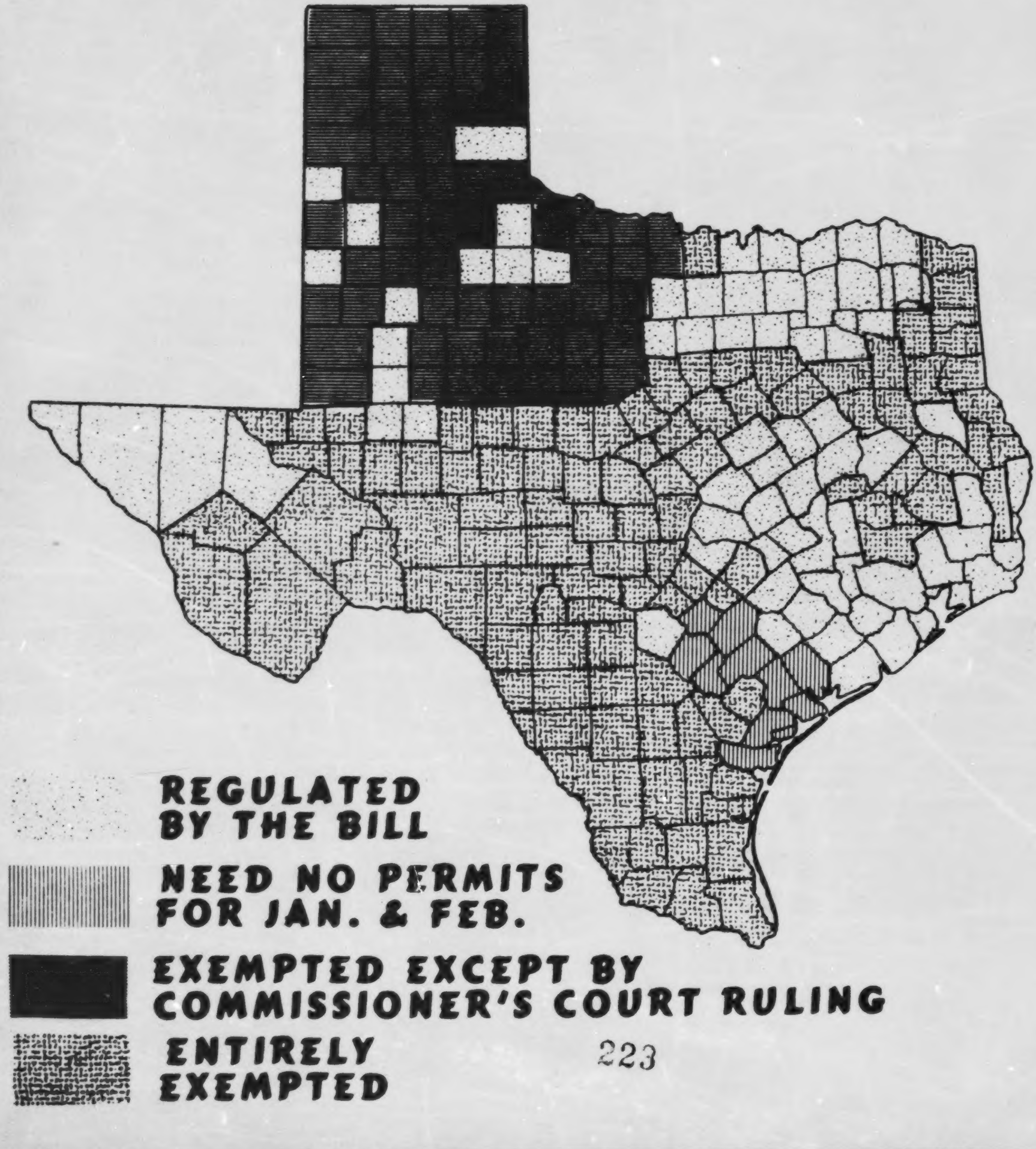
General use—Pesticide use which will not cause excessive damage to the environment or endanger the applicator or other persons when applied according to label directions.

(NOTE: No certification requirements are necessary on the part of the applicator.)

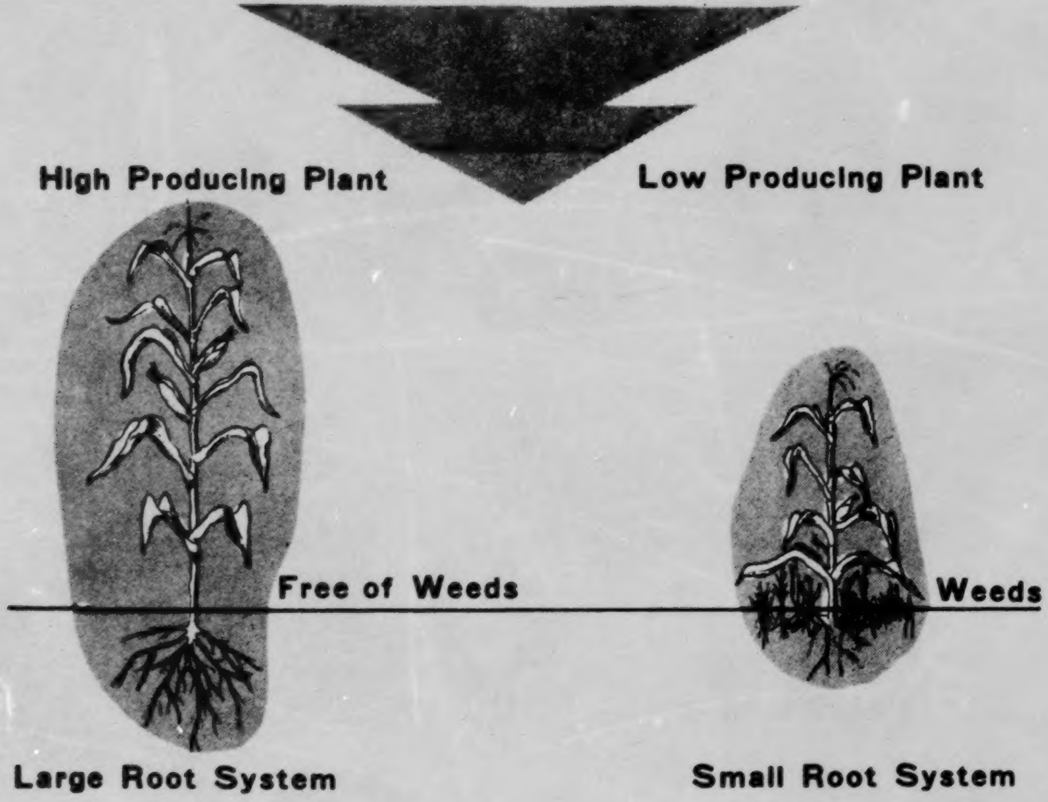
Restricted use—Pesticide use which may be a hazard to the environment, the applicator, or other persons even when label directions are followed.

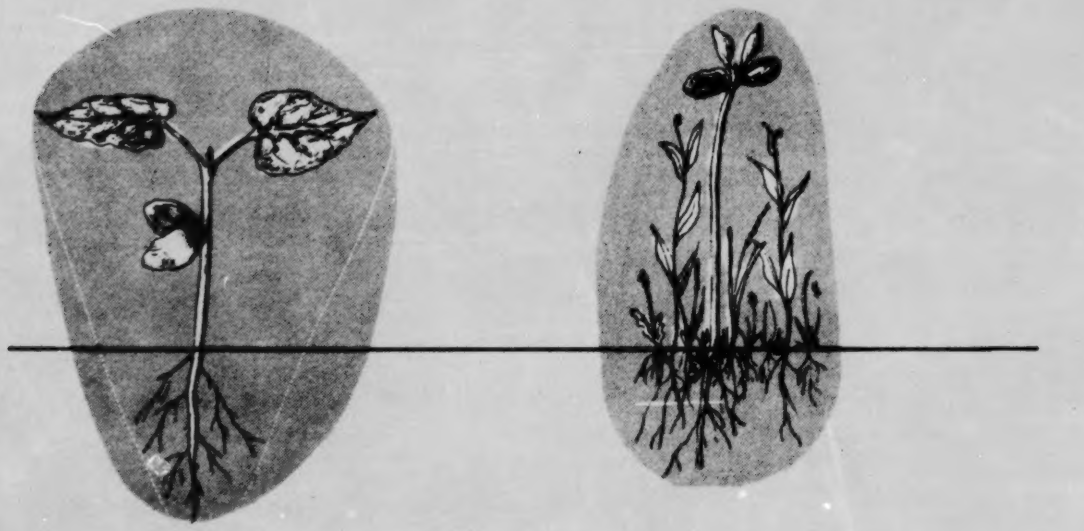
(NOTE: An applicator must be certified in order to buy and use restricted use pesticides.)

COUNTIES AFFECTED BY HERBICIDE LAW H.B. 402


REGULATED BY THE BILL
NEED NO PERMITS FOR JAN. & FEB.
EXEMPTED EXCEPT BY COMMISSIONER'S COURT RULING
ENTIRELY EXEMPTED

WEEDS CAUSE CROP YIELD LOSS


High Producing Plant
Low Producing Plant
Free of Weeds
Weeds
Large Root System
Small Root System


Normal Plant Free of Weeds
Abnormal Plant Among Weeds

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Weed Control

TOPIC: Classification and Identification of Weeds

OBJECTIVE: To lead the student to identify weeds according to life span and leaf structure and to know how weeds are spread.

REFERENCES:

Required:

1. Information Sheet, "Classification of Weeds".
2. "Controlling Weeds", VAS 4042, Illinois.

QUESTIONS OR ACTIVITIES:

1. How are weeds classified according to life span?
2. How are weeds spread?
3. Why is it important to know the difference between annuals and perennials?
4. Why is it important to know how weeds are spread?
5. Why is leaf structure of weeds and weedy grasses important to a farmer?
6. What are the best ways to control the various types of weeds and weedy grasses?
7. What are the two types of weeds that must be avoided in seed?
8. How are weed seed spread by the farmer?

Information Sheet
on
CLASSIFICATION AND IDENTIFICATION OF WEEDS

Classification of Weeds According to Their Life Span

ANNUALS

Plants (weeds) that complete their life cycle each year, starting with the seed.

BIENNIALS

Plants (weeds) that require two years to complete their life cycle, starting from the seed.

PERENNIALS

Plants (weeds) that live longer than the biennials (more than two years). They may reproduce from sexual and asexual reproduction. The above-ground portion of a perennial develops from the roots each spring and it dies back each winter.

Some Common Kinds of Weeds

ANNUALS:

Crabgrass
Lambsquarter
Common Ragweed
Dodder
Wild Mustard
Peppergrass
Morning Glory
Common Chickweed
Annual Bluegrass
Barnyard Grass
Pigweed
Wild Oats
Purple Nightshade
Cocklebur
Sandburs
Foxtail
Chess
Corn Cockle

BIENNIALS:

Burdock
Poison Hemlock
Wild Carrot
Bull Thistle

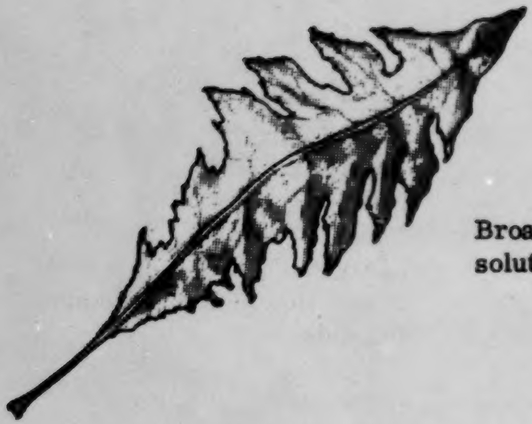
UNIT: Weed Control
TOPIC: Classification and Identification of Weeds
(Information Sheet continued)

PERENNIALS:

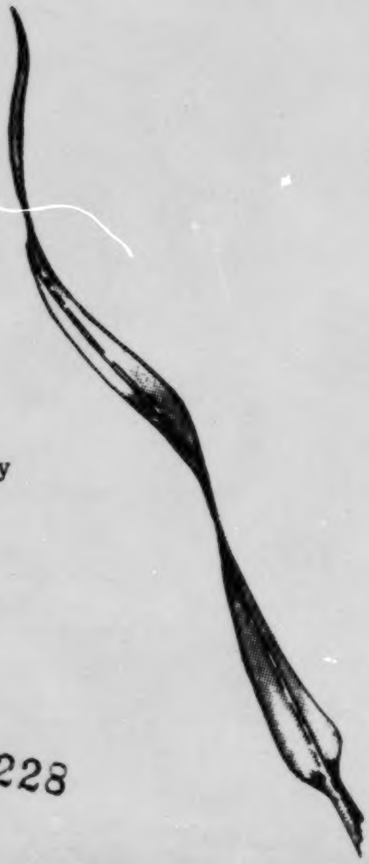
- Dandelion
- Sheep Sorrel
- Snapdragon
- Curled Dock
- Johnson Grass
- Nut Grass
- Quack Grass
- Wild Onion
- Field Bindweed
- Bermuda Grass
- Canada Thistle
- Leafy Spurge
- Broad-leaved and Buckhorn Plantain

Weeds and weedy grasses are generally classed by their leaf structure, either as broadleaf plants or straight and narrow leaf plants. Almost all broadleaf plants can be killed or burned severely by using one of the hormone type herbicides, 2 , 4-D or 2-4, 5-T. It is necessary to use extremely strong solutions of these herbicides to damage the narrow leaf type plants. Therefore, specific herbicides must be used on narrow leaf plants.

LEAF STRUCTURE



Broadleaf plants are destroyed by using a moderate solution of the hormone type herbicide.



A strong solution of a herbicide is necessary to destroy a narrow leaf plant.

SEED LABEL

LOT NO. A8297H NET WT. 50#

GROWN ARIZ. TESTED 12-63

KIND COMMON BERMUDAGRASS (HULLED)

GERMINATION 85%

PURE SEED	95.87%
INERT MATTER	1.33%
OTHER CROP	2.78%
WEED SEED	.02%
NOXIOUS WEED SEED PER LB.	NONE

TEXAS

KIND VARIETY LOT NO.

ORIGIN

PURITY ___% WEED SEED__% INERT MATTER___%

OTHER CROP SEED___% GERM. DATE

GERMINATION___% HARD SEED___%

NAME AND NO. NOXIOUS WEEDS PER OZ.

VENDOR

ADDRESS

OUT OF STATE

UNIT: Weed Control
TOPIC: Classification and Identification of Weeds
(Information Sheet continued)

How Weeds Are Spread

WIND SCATTERS WEED SEED

Weed seeds with a parachute-like attachment are carried by the wind. For example, dandelions, milkweeds, and bull thistle may be carried a long distance from the parent plant.

Some weeds grow in a circular or ball-type form as they mature. At maturity the plants break off near the soil surface and are rolled or tumbled on the soil surface by the wind. Russian thistle and tumbling mustard scatter seed as they roll along the surface.

Ticklegrass breaks off near the surface, and seeds are scattered as the awn-type attachment bounces along the surface.

ANIMALS SPREAD WEED SEED

Some weeds such as peppergrass, broad-leaved plantains, and mustards, have seeds that are sticky when wet. They stick to the animal's fur and are carried to different places.

Cockleburs, sandburs, and other barbed seed cling to the hair or wool on animals until they are rubbed off or lost by other means from the animal's body.

Seeds pass through the digestive system of animals as they move about over pastures.

Birds drop seed in flight, and some scatter seed in their droppings.

Seeds with a cork or other light covering float in water. Curled dock and some ragweed seed are carried long distances by water.

Some weeds have roots or underground stems which grow in many directions producing new plants.

UNIT: Weed Control
TOPIC: Classification and Identification of Weeds
(Information Sheet continued)

HOW THE FARMER SPREADS WEEDS

Weed seed is spread by machinery as it is moved from field to field during plowing and cultivation operations.

When crops are harvested, weed seed are carried in the hay, grain, and other crops to a different location on the farm or ranch.

Every lot of crop seed sold for seeding purposes should, according to the law, bear a label giving the purity of the seed, the percent of weed seed present, and the names and amount of noxious seed. Many farmers who use home grown seed, plant noxious weed seed at the time they are planting their crops.

Two Types of Weeds That Must Be Avoided in Seed

Primary noxious-weed seeds include:

Bindweed
Nutgrass
Blueweed
Johnson grass
Russian knapgrass
Wild Onion
Quackgrass
Canada thistle
Bermuda grass

Secondary noxious-weed seeds include:

Dodder
Cocklebur
Goatgrass
Wild radish
Red rice
Wild carrot
Chess
Persian ryegrass
Dock and sorrel
Wild mustard
Wild oat
Buckhorn plantain
Puncture vine
Morning glory

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Weed Control

TOPIC: Control by Mechanical Methods

OBJECTIVE: To teach students how to control weeds by mechanical methods.

REFERENCES:

Required:

1. Information Sheet, "Control of Weeds by Mechanical Methods".

QUESTIONS OR ACTIVITIES:

1. Give four ways of controlling weeds by mechanical methods.
2. What should be known about a weed in order to control it?
3. What is necessary before weeds can be permanently destroyed?
4. List five early methods of controlling weeds.
5. Why are certain crops planted to permit cross cultivation?
6. What are the functions of the following two cultivators: surface and disk?
7. What is the most common mechanical method of controlling weeds?

Information Sheet
on
CONTROL OF WEEDS BY MECHANICAL METHODS

In order to effectively control weeds, a control program must be planned. In order to plan a control program, the farmer must know how the weeds reproduce and spread, how they react to environmental changes, how they adapt to different habitats, and how they react to herbicides or to different methods of mechanical control.

One of the first steps in weed control is to eliminate seed production, if possible, since most weeds are reproduced by seed.

Plant food is made in the leaf. If we repeatedly destroy top growth of the weed, we will eventually destroy the weed. Therefore, this is the second step in controlling weeds. In other words, if a plant uses its food faster than it can make new food, it will soon grow itself to death.

We can also destroy underground roots or rhizomes by exposing them to drying and freezing conditions at the soil surface. This can be done by repeatedly plowing and replowing. If a plant reproduces from roots or rhizomes, new seedlings should be destroyed before the root system has time to develop. Once the roots have developed, it is difficult to completely destroy the plant by mechanical methods. A very good example of this is johnson grass.

Mowing or shredding

Weeds are damaged most by mowing when they are in budding or in bloom.

Annuals are easier to destroy by mowing than are perennials.

If plants are mowed repeatedly, their food reserves are depleted and they die. Annual weeds must be mowed before they can produce seed.

Some plants must be controlled by methods other than mowing. Plants which grow close to the ground cannot be destroyed by a mower.

Weeds, like dandelions and thistles, have enough plant food stored in their roots to produce a new growth and seed, even though they have been cut off by a mower.

UNIT: Weed Control
TOPIC: Control by Mechanical Methods
(Information Sheet continued)

Mowing or shredding is a popular method of controlling weeds on pasture land. After a weed reaches a certain stage of maturity it is difficult to destroy it with herbicides; therefore, a mechanical method of control is necessary.

Controlling weeds by cultivation

One of the main reasons for cultivating loam and sandy soils is to kill weeds.

Annual weeds can be almost totally eliminated from row crops by frequent cultivation. Perennials and biennials can be reduced by cultivating frequently.

Cross cultivation is advantageous when it is possible to use. This system of cultivation destroys weeds on all sides of the plant.

Newly germinated weeds are easily destroyed if the soil is stirred so that their roots are broken loose from the soil and exposed to sunlight. The rotary hoe, field cultivator, or harrow is used to cultivate field crops.

Many weeds are destroyed during seedbed preparation by moving the soil with such equipment as the plow, disc, harrow, and cultivator. Fall plowing is used to destroy perennial weeds. This system exposes the root stocks to the winter weather conditions.

Heat control method

Fire is used in many ways to control weeds. The most common ways are:

> Flame throwers are used to control weeds where other methods are impractical. For example, weeds are killed in gullies, on railroads, and in certain cases along fence lines by flame throwers.
>
> Flame cultivation is a practical method of controlling weeds in cotton after the stalk is about 3/16 inches in diameter. Weeds should be flamed before they reach the height of 3 to 4 inches. Flaming usually costs more and takes more time than other methods of cultivation.
>
> Complete burning may be used to destroy the mature plant or the tops of weeds that have been cut off by the mower. Burning will not destroy most seeds that have fallen to the ground from mature plants.

UNIT: Weed Control
TOPIC: Control by Mechanical Methods
(Information Sheet continued)

The control of weeds by smothering

Straw mulches, building paper, and plastic sheets may be used to smother small patches of weeds. Strips of plastic may be used to keep (tomatoes, strawberries, and other plants) the soil clean of vegetation around the plant.

Soil spread over the weed by a plow or cultivator also smothers the plant.

Flooding as a method of controlling weeds

Areas that are flooded from 3 to 5 weeks are almost free of weeds at the end of the flooding period.

Flooding excludes air from the plant; therefore, the roots and entire leaf structure must be submerged in order to obtain a complete kill.

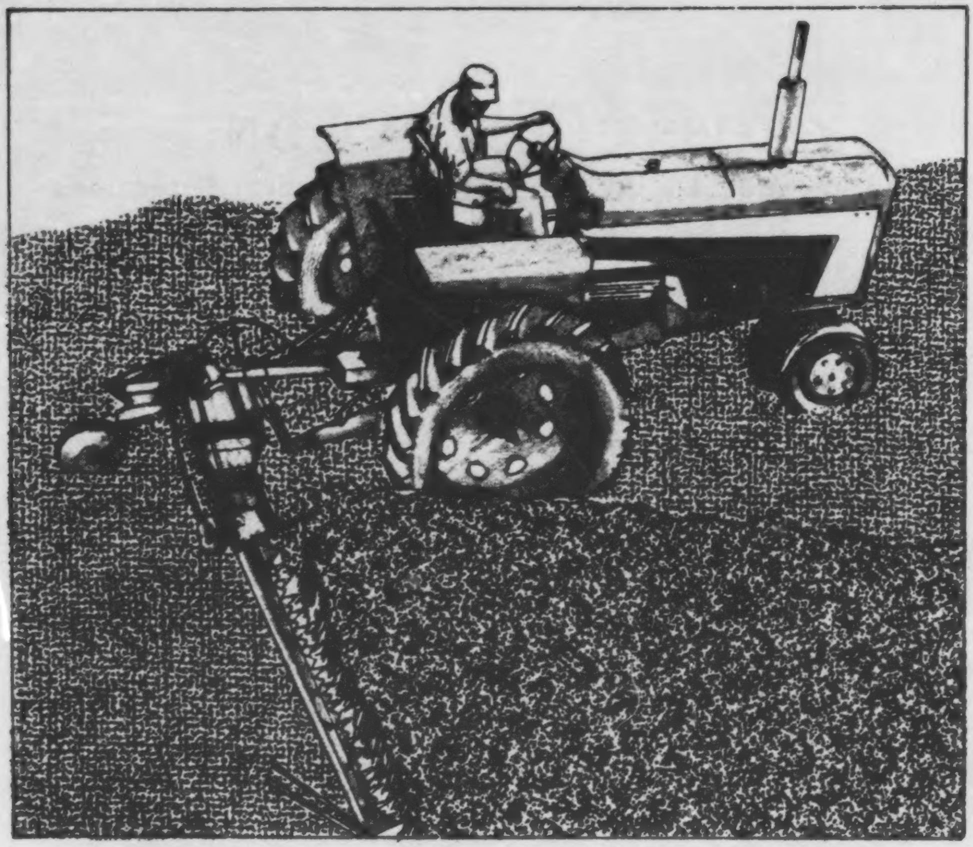
Weeds are controlled in rice production by flooding.

The early methods of controlling weeds were as follows:

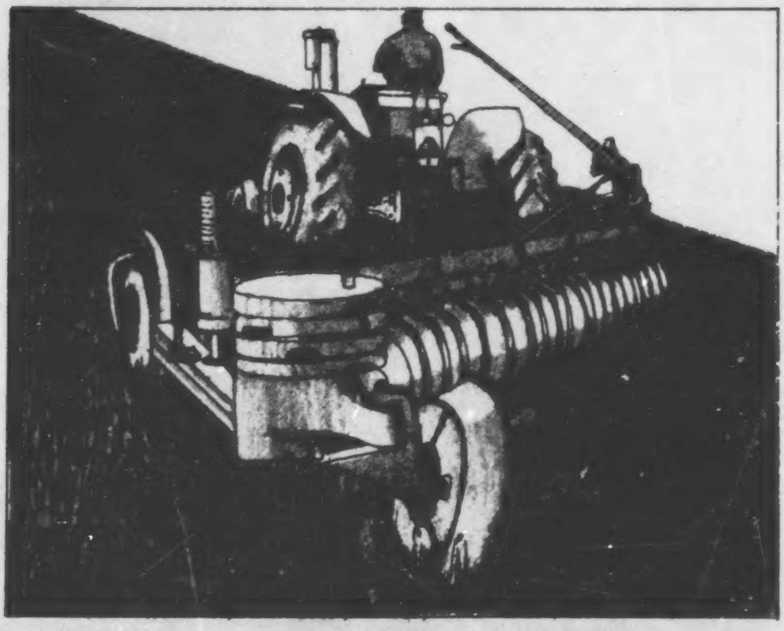
1. Soil was plowed deep to bury weed seed and destroy perennial root systems.
2. Weed seedlings were uprooted by using sweep type cultivators.
3. Weed seed were allowed to germinate before cultivating the soil.
4. Weed roots were cut below the surface.
5. Weeds were covered with soil in order to smother or bury the weeds.

The main reasons for cultivation are to aid the crop plant by destroying undesirable vegetation and maintaining soil conditions favorable to plant growth.

Weed Control By Mowing:

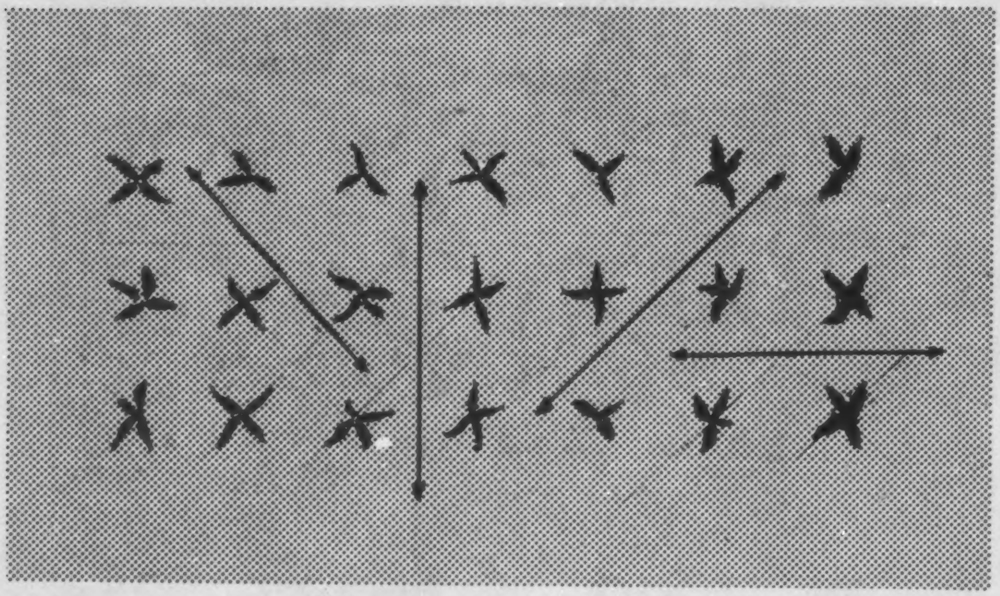


Weed Control By Plowing:

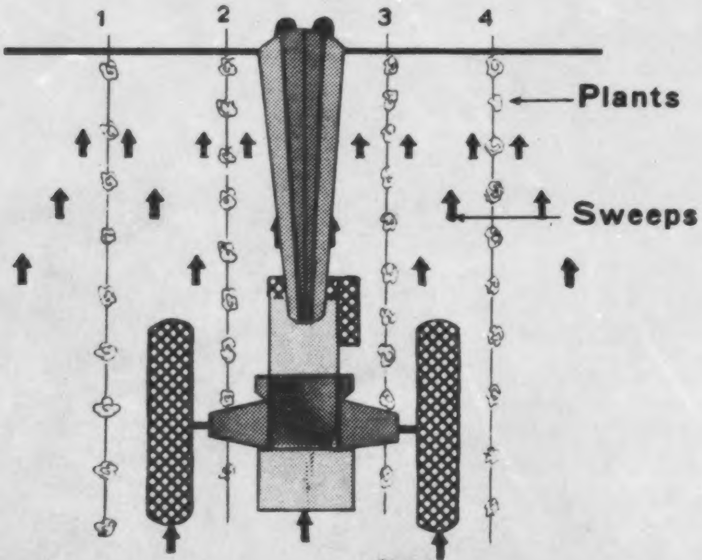


CROSS CULTIVATION

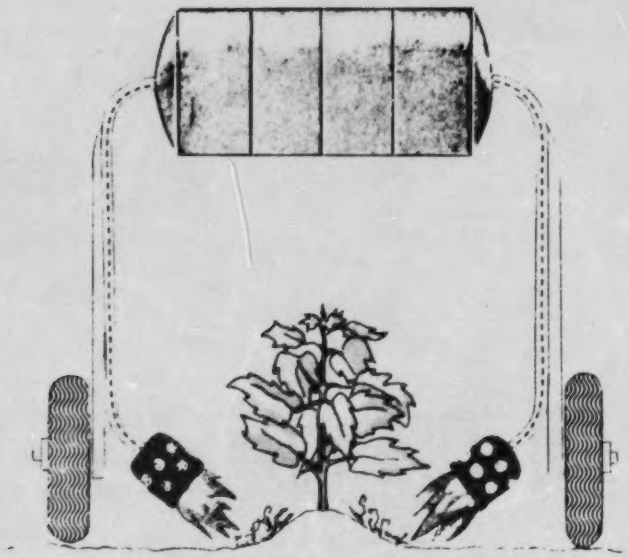
Cultivation May Be Accomplished In Several Directions



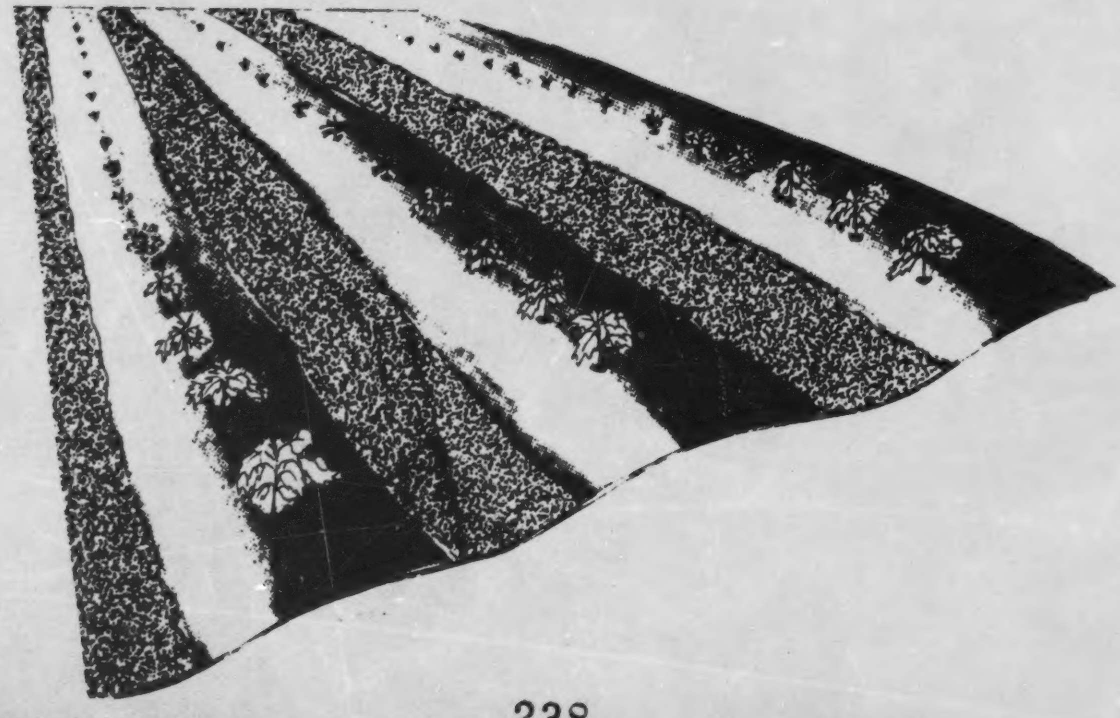
FOUR-ROW CULTIVATOR


1
2
3
4
Plants
Sweeps

Flame Cultivation



Plastic Mulch



Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Weed Control

TOPIC: Chemical Methods for Control

OBJECTIVE: To become acquainted with and be able to use some chemical methods of controlling weeds.

REFERENCES:

Required:

1. Information Sheet, "Chemical Methods for Controlling Weeds".
2. "Controlling Weeds", VAS 4042, Illinois.

QUESTIONS OR ACTIVITIES:

1. What should be stressed first in the use of chemicals?
2. Give four things to consider in controlling weeds with chemicals.
3. Does the use of herbicides eliminate the need for tillage?
4. Do herbicides differ in ease of application and effectiveness of controlling weeds?
5. What are the four ways chemicals can be applied to the soil to control weeds?
6. What are the methods of applying herbicides?
7. What are the three main types of herbicides?
8. Why is it a good practice to apply a spray at the same time the mixture is made up?
9. What is the difference between a contact and systemic weed killer?
10. List the factors that affect the effectiveness of weed killers.
11. List the main parts of spraying equipment.
12. Name the type of sprayer for the following uses:
    - a. Flower beds
    - b. Fruit trees
    - c. Nursery spraying
    - d. Control of row-crop grasses
    - e. Placing chemicals several inches into the ground
13. Why is it important to read the label and follow the precautions on the label?
14. Why is it important that proper calibration methods be used?
15. List the four practices that should be followed when calibrating a sprayer.

Information Sheet
on
CHEMICAL METHODS FOR CONTROLLING WEEDS

Treatment of weeds with chemicals involves use of technical methods and observing certain specific details. A certain degree of risk may be entailed. For these reasons and because chemicals and methods for their use are constantly changing, anyone contemplating chemical weed control will need to obtain full information on the subject from the proper source or sources before undertaking the operation. Also, the manufacturer's instructions must be followed closely.

Timing is important in weed control. Generally, you can get more effective weed control faster and with a smaller amount of chemicals when conditions are right. Here are some factors to watch for:

1. Stage of weed growth - Generally weeds are easier to control when they are young and actively growing. As plants approach maturity, the efficiency of herbicidal action decreases. On the other hand, with perennial weeds, applications made at certain later stages of development may be more effective than earlier treatments due in part to a large amount of leaf absorbing surface and also to the fact that a considerable amount of root reserve energy has been expended just prior to blooming.

2. Soil conditions - Warm, moist soil favors rapid growth of seedlings and is conducive to high effectiveness of applied herbicides. Drought conditions make it more difficult to get good control. The type of soils also influences herbicidal retention from pre-emergence treatments. There is more leaching in light, sandy soil than in soils containing higher amounts of organic matter and clay. For best results from applications of Dowfume MC-2 as a seedicide, or Premerge as a pre-emergence herbicide, soil should be well-worked, moist, and free of trash before application.

3. Rainfall - Rain immediately following application of a foliage herbicide may reduce its effects by washing it from weed leaves before it has been absorbed. Later, rain may actually help herbicidal action by improving growth action of weeds. Too much rainfall after application may prove detrimental to some crops, however, since it can cause some herbicides to leach into the crop root zone and cause injury. Light rain after application of a pre-emergence herbicide is beneficial.

4. Temperature - Air temperature is important to the proper action of some herbicides. Higher temperatures generally speed up herbicidal action. Lower temperatures retard it. Therefore, it usually is necessary to use higher application rates under low temperature conditions.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

5. Humidity - Humidity can also play a part. Usually under very dry conditions a herbicide may be less effective than under average humidity conditions found in the humid areas of the country.

Chemicals - Teammates of Tillage

The important thing to remember when you decide to make use of modern farm chemicals is this: herbicides are not meant to replace tillage; they are designed to reduce it.

Chemicals are a profitable supplement to good cultural practices. For example, the availability of weed killers does not lessen the importance of selecting good, clean seed. Clean seed is one way to stop weed problems before they start.

Thorough tillage and seedbed preparation is important in the control of weeds, as well as in assuring a hearty start for crop plants. Often, it may be advisable to plow land early, allow weed seed to germinate, then kill them with a shallow cultivation or with a contact spray. This eliminates at least one phase of weed growth.

Early weeds in row crops may be controlled with a herbicide, such as Premerge, but this does not necessarily eliminate the need for later cultivation to control weeds that got a late start.

Chemicals for weed control can be used most profitably when they become a part of sound farm management - management that calls for wise seed selection, proper tillage practices, and good fertilization programs.

Chemical Control of Weeds

Chemicals used for the control of weeds are called herbicides. Basically, herbicides destroy the plant's ability to produce chlorophyll. Plants absorb the chemical either through the root system or through the leaves.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

Preparing Herbicides for Use

Herbicides are available for killing most weeds and, if properly used, they do not damage desirable plants.

A farmer should not depend solely on herbicides. These should be used only when necessary and as a part of management practices including fertilization, disease and insect control, and irrigation, if necessary.

Herbicides differ in ease of application and in effectiveness. They also differ in selectivity. (For example, one herbicide may remove weeds without injury to others; another herbicide may temporarily, or even permanently injure others.)

Herbicides are sold in liquid, powder and granular forms. Most of them have common names derived from their chemical names.

The plant-killing strength is stated on labels in two ways, either as pounds per gallon acid equivalent or as percent of active ingredient. The active chemical ingredient is always included on the label.

Questions frequently arise concerning the compatibility of various spray chemicals. Incompatibility can occur in several forms. Sometimes the toxicity or length of residual effectiveness of a pesticide is reduced in a mixture. Sometimes incompatibility means a mixture of chemicals will cause injury to plants, but materials used alone are safe. Often, incompatibility means that mixtures left standing in a tank for more than a few hours lose effectiveness, but if sprayed out quickly lose no strength. It is a good practice to apply any spray the day it is made up.

Commercial spray operators should obtain a spray compatibility chart. An excellent one is available from American Fruit Grower, Willoughby, Ohio. In general, the recently developed synthetic organic pesticides are compatible in mixtures. Modern insecticides such as toxaphene, malathion, Kelthane, and others, are compatible with each other and with modern fungicides, such as captan, thiram, ferbam, maneb and ziram. Many of these should not be used in highly alkaline sprays and should not be mixed with lime or lime-sulfur. There are many herbicides that are not compatible with each other. Check a compatibility chart carefully before mixing summer oils or wettable sulfur with other pesticides. Oil and sulfur definitely should not be combined.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

The following compounds perform several functions in the spray solution.

1. Carrier - Many sprays have a carrier or diluent. This extends the active ingredient so it will cover entire plant surfaces. Water is the most common carrier. Oil is another carrier.

2. Filming agent - Used with oil sprays to cause a thin film of oil to spread over the plants enabling the contact herbicide to penetrate the surface of the plant.

3. Wetting agent - Water generally used as an aid in spreading material over the waxy surface of the plant.

4. Emulsion stabilizer - A stabilizer is used to reduce or lower interfacial tension between oil and water.

5. Solvent or coupling agent - Where the solubility of the toxic agent is not suited to the carrier or filming agent, a coupling agent is used.

6. Toxicant - Many of the new organic herbicides are extremely toxic. In many mixtures they make up only a fraction of one percent of the total mix. Toxicants originally used in many oils are too low in effectiveness to be economically feasible for use. They are fortified with highly toxic-organic compounds, now a common practice.

Oil may serve as a filming agent, as a dual agent, or as a solvent for the toxicant.

Herbicides are commonly classified according to the time of application. Generally, they are applied as pre-plant, pre-emergence, and post-emergence.

Pre-plant - Pre-plant treatments are made before the crop is planted. The broadest and most commonly used meaning of this term includes all treatments, from those applied to seedbeds, shortly before planting, to post-emergence treatments of certain weeds.

Pre-emergence - Pre-emergence herbicides are applied before the crop or weeds emerge. They aid in controlling annual weeds, particularly annual grasses.

Post-emergence - Post-emergence herbicides are applied after the crop or weeds emerge. They help control many perennial, as well as annual weeds.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

After the time of application has been decided upon, the type of action the chemical has upon the weed should be considered.

1. Contact weed killers kill by contact rather than being translocated within the plant.

2. Systemic weed killers are translocated from the point of contact to other parts of the plant by the plant's system.

3. Selective weed killers are herbicides which have more effect on some plants than on others. This type of herbicide often allows the control of weeds without damage to the crop.

4. Non-selective weed killers kill all plants without regard to species.

5. Some chemicals have delayed action which causes a delayed response. They may cause the plant to stop developing, then it will gradually die from the treatment.

The factors affecting chemicals are as follows:

1. Stage of weed growth
2. Soil conditions
3. Rainfall
4. Temperature
5. Humidity

In order to get the best effect from chemical weed control, treatment should be applied when the weeds are young and actively growing. Warm, moist soil is best for favoring rapid growth of seedlings and will increase the effectiveness of a herbicide. Rain falling after an application of a herbicide may decrease its effectiveness by washing it from the leaves. Later, rainfall may help by improving growth action.

Higher temperatures help the action of chemicals in weed control.

Average humidity conditions are best for optimum control.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

Methods of Treatment

The methods of treatment for chemical control of weeds will differ with the weed to be controlled and the chemical used. Herbicides are applied by broadcast treatment, row or band treatment, spot treatment, or by directed spray.

Broadcast Treatment - A broadcast treatment refers to an application which covers the entire area or field at a uniform rate.

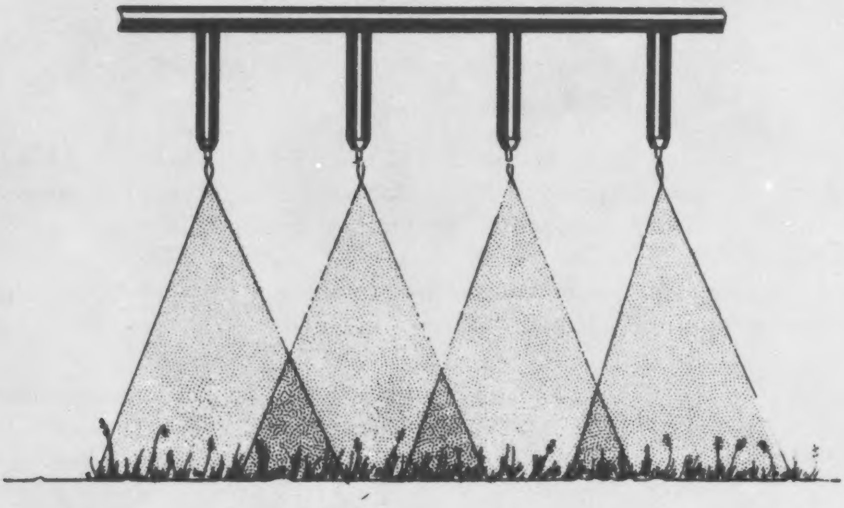
Row or Band Treatment - This treatment involves the application of a band of chemicals directly over the row. Weeds between the rows can then be controlled by cultivation. This type of treatment is relatively low in cost.

Spot Treatment - Spot treatment is used for limited areas which are infested with weeds. It is primarily used because certain weeds require special treatment or because the weed distribution is too limited to justify treatment of the entire field. The chemical is usually applied by a sprayer.

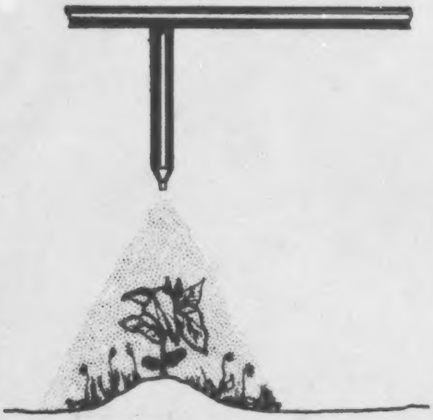
Directed Sprays - Directed sprays are treatments which involve directing the spray to a certain part of the plant. Non-selective herbicides must be applied beneath the leaves of crops.

Soil fumigation is the application of a chemical to the soils before planting to kill weed and grass seeds before they can germinate and grow.

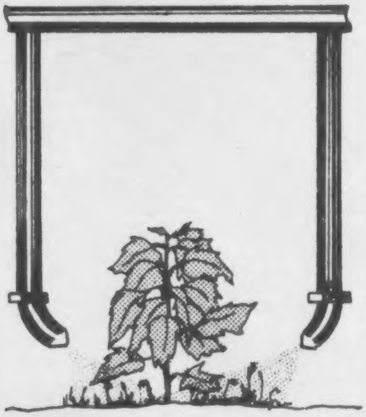
APPLICATION OF HERBICIDES



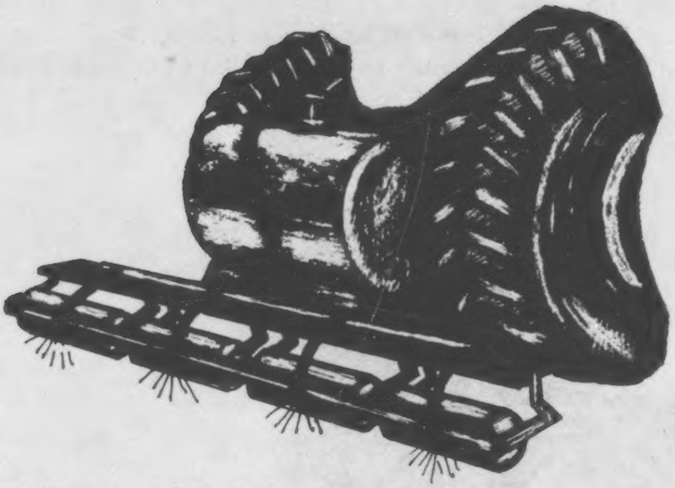
BROADCAST SPRAY PATTERN COVERS ENTIRE AREA



BAND SPRAY PATTERN
OVER THE ROW

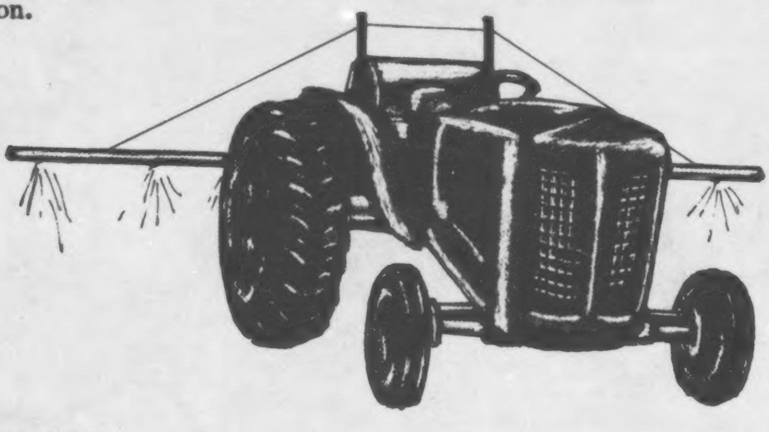


DIRECTED SPRAY
BENEATH PLANT LEAVES



ROW TREATMENT (Band Treatment)

A saving in time and chemical cost can be realized by treating only the row area where the crop is planted. Row treatment is often used in the application of Premerge, and may be done at the time of planting or afterward. If spray is applied at planting time, the sprayer nozzles are mounted behind the press wheels or slide (see illustration). A band of 12 to 16 inches is usually treated. Results of row treatment in a peanut field are shown in the accompanying illustration.

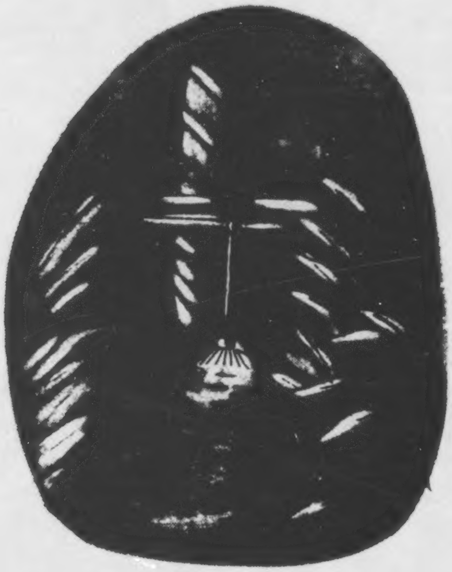


FIELD SPRAYING

Over-all field spraying is done with a boom sprayer (see illustration) which can be either tractor or trailer mounted. On a boom-type sprayer, nozzles are spaced so that the spray patterns from each nozzle give complete coverage of the area to be treated.

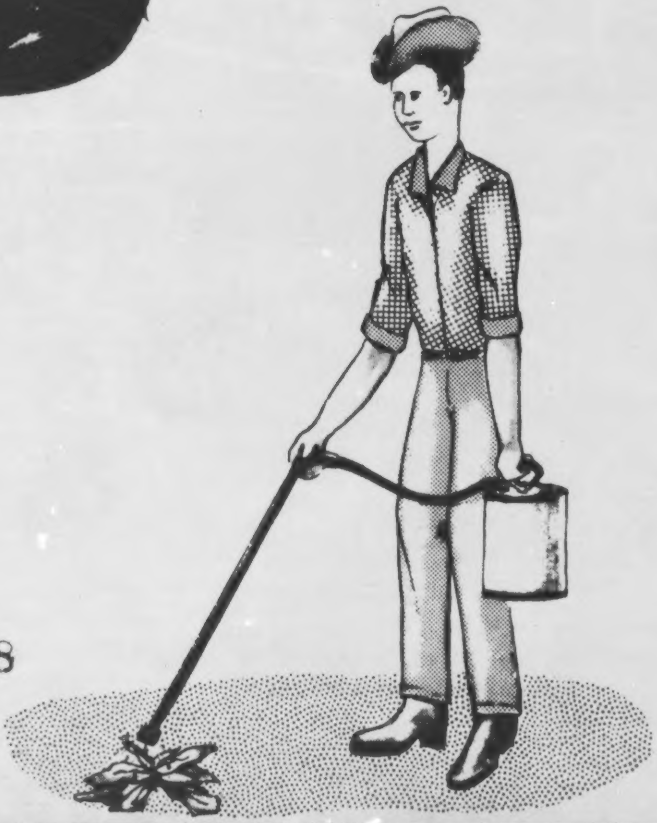
ROW TREATMENT WITH DROP NOZZLES

By using drop nozzles (see illustration), weeds in row crops such as corn may be sprayed when the corn is fairly well developed. The drop nozzles serve as extensions of the boom, allowing the spray to be directed to the base of the plant, thus avoiding spraying the foliage which may be susceptible to damage from the spray.



SPOT TREATMENT

By using either knapsack sprayers or hose extensions from power equipment, weeds may be spot-treated in the field. Johnson grass and Bermuda grass growing in cotton are often treated in this manner.



UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

Spraying Equipment

Spraying fields and row crops represents the largest new use of spraying equipment. The equipment must be versatile and adjustable to the requirements of the spray job and the material being sprayed.

Points to consider before buying or building a farm sprayer:

1. What do I need to spray?
   (a) orchards, (b) row crops, (c) weeds, (d) hay crops, (e) others
2. How much am I justified in spending for a sprayer? Labor vs. cash outlay determines whether to buy or build.
3. Maximum pressure is determined by use.
4. Type and size of pump are determined by pressure and gallonage.
5. Is power take-off or separate engine best source of power?
6. What size tank and type of agitator will I need?
7. Do I need a boom or just a hand gun?
8. How adjustable should it be?
9. Do I want it tractor-mounted, or do I want a unit I can slip into the pickup truck?

Four types of applicators are as follows:

Aircraft Sprayers - Aircraft spraying is usually done by commercial concerns either by contract on an annual basis or on a per acre basis. This may include all costs or the farmer may supply all the materials and pay the pilot or concern the cost per acre for application of the materials used.

Fumigant Injectors -

Plow application - These deliver the fumigant to the furrow as the soil is turned. The soil must be sealed immediately after the fumigant is used to prevent loss of the fumigant.

Tooth or Chisel Applicators - These applicators are attached to the tractor-mounted cultivators or mounted on trailer-type cultivators. The chisels or teeth are usually spaced 10 to 12 inches apart. The chisels place the fumigant 6 to 8 inches into the ground by means of tubes attached to the chisels. When this is used, the chisel furrows must be filled and sealed immediately behind the applicator.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

Soil Incorporators - This equipment thoroughly mixes agricultural chemicals with the soil in such a way that the chemical actually becomes part of the soil.

Major Parts of Spray Equipment

PUMPS

Any good pump that will deliver the required volume of spray under the desired spraying pressure is suitable. Pumps differ in operating principle. Gear pumps and reciprocating piston pumps are positive action type pumps. Impeller pumps and centrifugal pumps usually are not. Self-priming is an asset in a pump, but is not a necessity if the pump is to be mounted below the level of the supply tank. The pumps should be able to deliver from 3 to 10 gallons per minute and always be operated at the correct speed. Pump life will be prolonged by proper care. After each day's use, pumps should be thoroughly cleaned, and at the end of the season, filled with a rust preventative.

SUPPLY TANK

Pick a durable container with adequate capacity to do the job. It should be easy to clean and need not withstand pressure if a pump is to provide the liquid pressure. Many farmers use clean oil drums for tanks. A rusty one may cause continuous trouble by plugging nozzles. A paddle-type agitator, or hydraulic agitation from excess pump capacity, will be necessary if the spray solution requires agitation in use.

PRESSURE REGULATORS

By-pass regulators are used with positive action type pumps. Diaphragm pressure regulators may be used with nonpositive action pumps. The regulators permit excess liquid to flow back to the supply tank. Proper adjustment of the regulator maintains the proper amount of constant pressure at the nozzle.

VALVES

In addition to the several gate or globe valves on a weed sprayer, the sprayer should have a fast acting shut-off valve that will start or stop the flow of spray to the boom.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

PRESSURE GAUGE

An accurate pressure gauge is important to precision spraying. It should be mounted so the operator can see it easily.

STRAINERS

Proper strainers will save time and trouble in spraying. A field sprayer should have an 80-100 mesh suction strainer or a 100-150 mesh strainer on the pressure line, as well as strainers in each nozzle. The mesh in a nozzle strainer is determined by the size of the nozzle orifice.

SPRAY BOOMS

Booms should be made of corrosion-resistant metal. Galvanized steel pipe is widely used and is satisfactory.

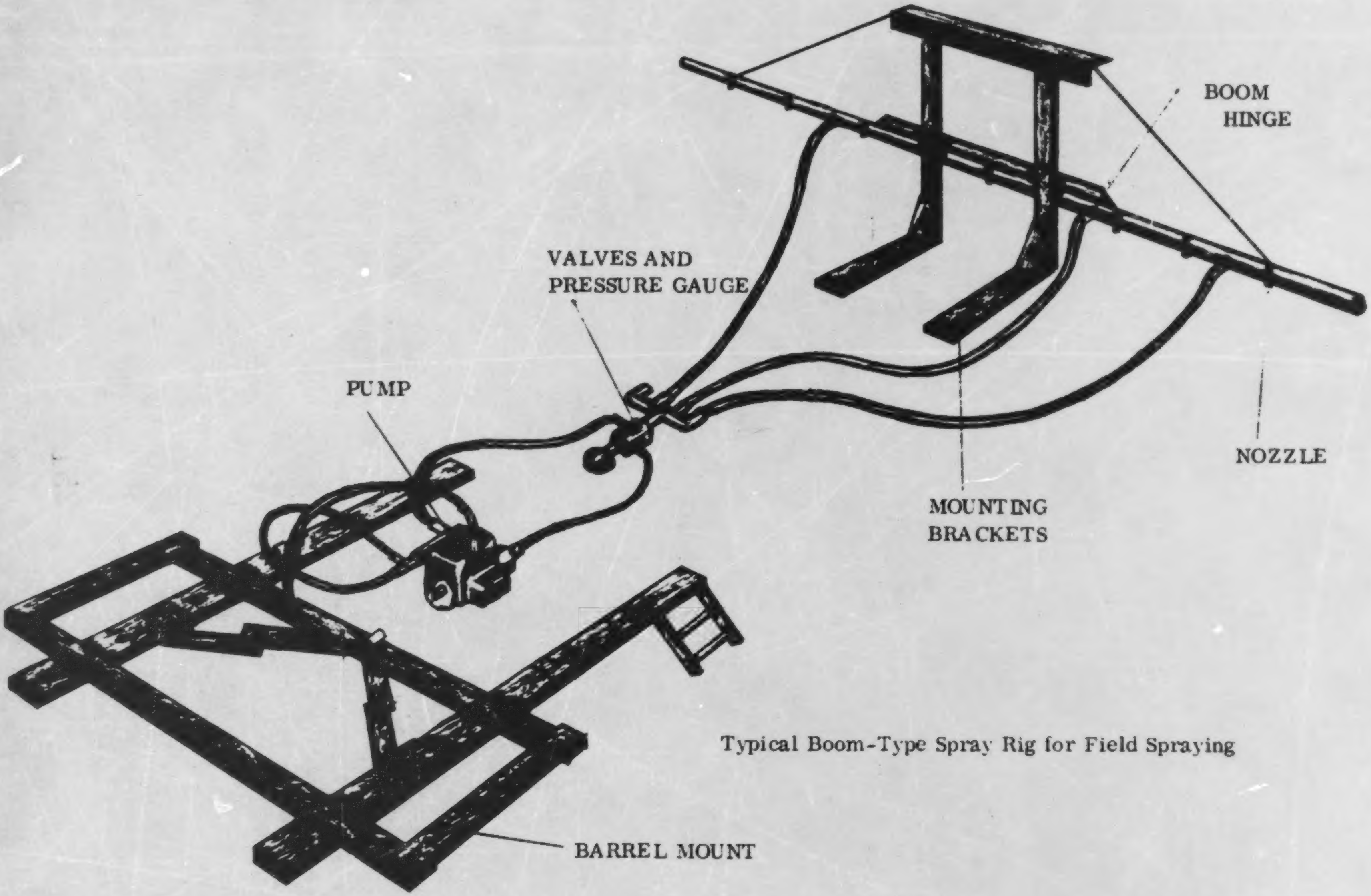
HOSES AND FITTINGS

Hoses and fittings should be strong enough to withstand the pump pressure used, and should be of material not subject to deterioration by spray solutions including oil. Pipe fittings should be of a corrosion-resistant metal such as brass.

NOZZLES

Two general type of nozzles are available for applying weed sprays: the single broadcast nozzle and the smaller fan nozzle mounted on a boom. The broadcast nozzle is so constructed to produce a spray pattern of considerable width. The higher the nozzle is held above the ground, the greater the swath width. Such nozzles are used singly or in clusters to cover widths up to sixty feet. Uniform spray patterns from such nozzles are difficult to obtain when there is any wind.

Fan type nozzles are usually preferred to cone type nozzles. Such nozzles are attached to booms of varying lengths of eyelet fittings. Fan nozzles are available in several spray angle types. Narrow angle spray nozzles (65°) are useful for certain types of spraying. The usual nozzle spacing on the boom is 20". If the narrow angle nozzles are used, it is necessary to maintain greater boom height than with the wider angle nozzles. The higher the boom is from the ground, the greater the spray interference caused by wind will be.


BOOM
HINGE
VALVES AND
PRESSURE GAUGE
PUMP
NOZZLE
MOUNTING
BRACKETS
BARREL MOUNT

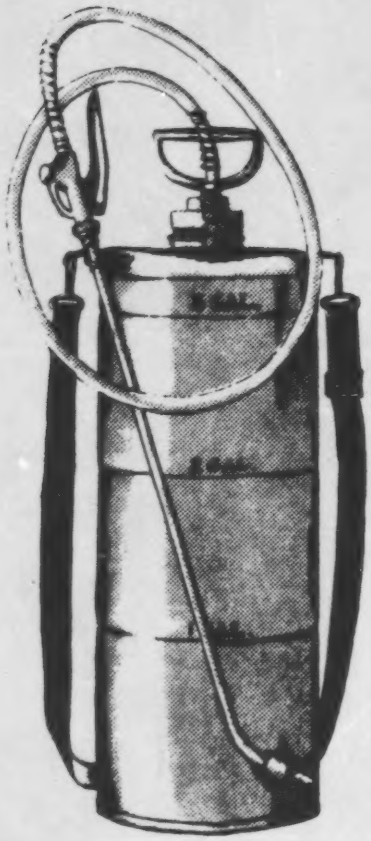
Typical Boom-Type Spray Rig for Field Spraying

Pressure - Capacity Information for Various Spray Jobs

Spray Job	Pressure PSI	Gallonage
Trees	300 to 400	9-12 gal. per minute
Alfalfa Weevil	100 to 200	30-50 gal. per acre
Row crop	30 to 50	30-50 gal. per acre
Weed control	30 to 50	30-60 gal. per acre

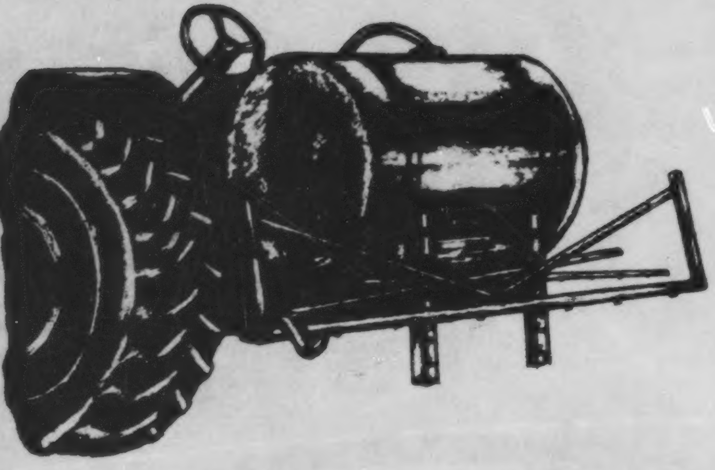
Types of Spraying Equipment

1. Knapsack (hand sprayers). Used on small areas for a variety of purposes. This includes the small 1-3 gallon pressure hand carried sprayers.

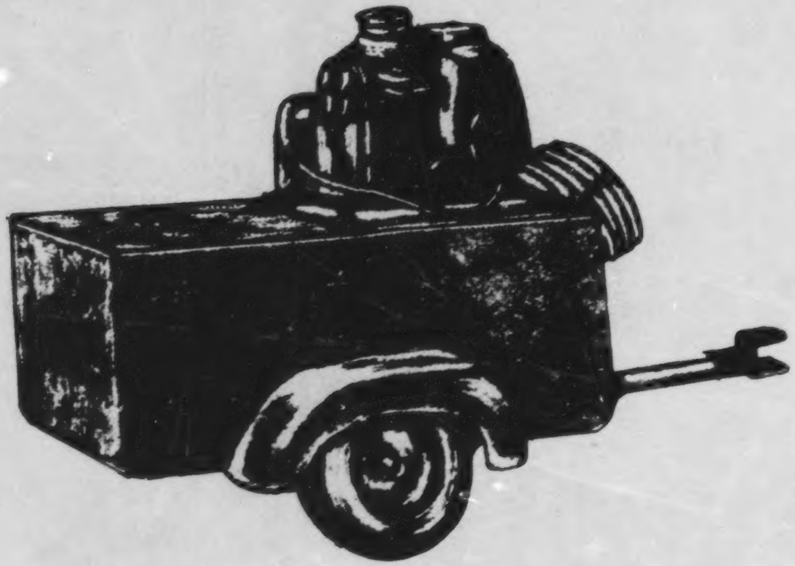


Tractor-mounted -
High pressure, high volume. These sprayers are used primarily by commercial growers of fruit and truck crops. They provide the high pressure, high volume spray delivery required for complete coverage of fruit trees in full foliage and dense growth of vine and truck crops.

Low pressure, low volume. These sprayers are designed primarily for low pressure, low volume spraying - less than 100 pounds pressure and 3 to 50 gallons per acre application recommended for insect, disease, and weed control in crops.



Tractor-Pulled Sprayer - Used on small areas for a variety of purposes. This is often referred to as a general use sprayer. These sprayers include the power wheelbarrow, the estate or small wheel-mounted and skil-mounted sprayer unit. These sprayers are designed to handle spraying jobs that are too large for hand equipment. Jobs for which they are used include garden spraying and small tree and nursery spraying.



UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

A representative chart showing the delivery in gallons per acre from various size orifices at pressures ranging from 20 to 100 psi and traveling at speeds of 2 to 5 miles per hour is shown. More complete data may be obtained from nozzle manufacturers. The chart included here gives approximate orifice sizes, speeds, and pressures for the more common application rates. The first two digits (80) in the code numbers in the nozzle column refer to the fan spray angle - i. e., 80 degrees. These are Spraying Systems Company nozzles but other suitable makes may be available. Other special nozzles delivering uniform spray over the entire pattern are available for precision pre-emergence application. Under certain circumstances, a spray pattern that delivers more spray to one side of the orifice is desirable for directed sprays. These are available from nozzle manufacturers.

Safety Precautions to Follow When Using Herbicides

Always, carefully follow the precautions on the label. This will help protect the operator, avoid crop injury, and prevent harmful residues in food and feed crops.

Use herbicides only on those crops for which they are specifically approved and recommended.

Use only recommended amounts. Applying too much of a herbicide may damage the crop; it may be unsafe if the crop is to be used for food or feed, and it is costly.

Apply herbicides only at times specified on the label. Observe the recommended intervals between treatment and pasturing or harvesting of crops.

Wear goggles, rubbergloves, and other protective clothing as recommended on the label.

Guard against possible injury to nearby susceptible plants. Droplets of 2, 4-D and 2, 4, 5-T sprays often drift for several hundred yards. Spray only on a calm day or make sure air is not moving toward susceptible crop plants and ornamentals.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

SPRAY NOZZLE CHART*

Nozzle	Spray Pressure in PSI	Capacity 1 Nozzle in GPM	Gallons Per Acre			
			2 MPH	3 MPH	4 MPH	5 MPH
800067	20	.05	7.0	4.7	3.5	2.8
	25	.055	7.8	5.2	3.9	3.1
	30	.06	8.6	5.7	4.3	3.4
	40	.067	9.8	6.6	4.9	4.0
100 Mesh	50	.07	11.0	7.4	5.5	4.4
	60	.08	12.0	8.1	6.0	4.9
	80	.09	14.0	9.3	7.0	5.6
	100	.11	15.6	10.4	7.8	6.3
8001	20	.07	10.5	7.1	5.3	4.3
	25	.08	11.8	7.8	5.9	4.7
	30	.09	12.9	8.6	6.4	5.1
	40	.10	14.9	10.0	7.4	6.0
100 Mesh	50	.11	16.7	11.2	8.3	6.7
Screen	60	.12	18.2	12.2	9.1	7.4
	80	.14	21	14.1	10.5	8.5
	100	.16	24	15.8	11.7	9.5
80015	20	.11	15.7	10.5	7.8	6.3
	25	.12	17.5	11.7	8.8	7.1
	30	.13	19.2	12.9	9.7	7.7
	40	.15	22	14.9	11.1	8.9
100 Mesh	50	.17	25	16.7	12.4	10.0
Screen	60	.18	27	18.2	13.6	10.9
	80	.21	31	21	15.7	12.6
	100	.24	35	24	17.6	14.1
8002	20	.14	21	14.0	10.5	8.4
	25	.16	23	15.7	11.8	9.4
	30	.17	26	17.2	12.9	10.3
	40	.20	30	20	14.8	11.8
50 Mesh	50	.23	33	22	16.5	13.2
Screen	60	.25	36	24	18.1	14.4
	80	.28	42	28	21	16.7
	100	.32	47	31	23	18.7
8003	20	.21	32	21	15.7	12.6
	25	.24	35	23	17.6	14.1
	30	.26	38	26	19.3	15.4
	40	.30	45	30	22	17.8
50 Mesh	50	.34	50	33	25	20
Screen	60	.37	55	36	27	22
	80	.42	63	42	31	25
	100	.47	70	47	35	28
8004	20	.28	43	28	21	16.8
	25	.32	47	31	24	18.7
	30	.35	51	34	26	21
	40	.40	59	40	30	24
50 Mesh	50	.45	66	44	33	27
Screen	60	.49	73	49	36	29
	80	.57	84	56	42	34
	100	.63	94	63	47	38

* This chart is based on 20 inch spray nozzle spacing and 17 to 19 inch boom height.

COMMON CROPS, WEEDS CONTROLLED, AND HERBICIDES

Crop	Weeds Controlled	Herbicide
Cotton	Annual Grasses and Broadleaves	Chloro-IPC, Dacthal, Karmex DL, Zorial, Lorox, Caparol, DCPA, Treflan, Surflan, Tolban
	Annual Grasses Johnsongrass, Broadleaves, and Nutsedge	DSMA, MSMA, EPTAM 6-E MSMA + Diuron Herban + DSMA Tolban
	Annuals and Seedlings of Perennials, Johnsongrass	Arsan, Dowpon, DSMA, MSMA
Sorghum	Annual Broadleaves and grasses	Atrazine, Dicamba, Propazine, Igran, Bladex
	Broadleaves	2, 4-D Amino, Lorox Oil-Soluble Amino
Peanuts	Crabgrass, Colorado Grass, Pigweed, Carpetweed and Purslane	Balan, Enide, Dymid, DNBP, Dyanap Treflan, 2, 4 DB, Naptalam
Corn	Annual Broadleaves and Grasses	Atrazine, 2, 4-D Ester, Lorox, Modown Linuron, Simazine, Dicamba, Sutan (grasses)
	Broadleaves	2, 4-D Amine, Bladex, Prefox
Winter Wheat, Barley,	Annual Broadleaves, Field Bindweed, Annual Broadleaves, and Grasses	2, 4-D Ester, 2, 4-D Amine, Amiben, Tenoran, Lorox, Treflan, MCPA, Dicamba
Rice	Broadleaves	2, 4-D Amine, 2, 4, 5-T Amine
	Most Grasses Found in Rice Fields	Propanil, Ordram CIPC
Flax	Annual Winter and Summer Broadleaves	2, 4-D Amine
	Certain Annual Grasses	Sodium TCA
	Grasses and Broadleaves, Annuals	MCPA Amine + TCA
Soybeans	Annual Grasses and Broadleaves	Amiben, Naptalam, Dyanap, Surflan

IRRIGATED VEGETABLES

Beans	Annual Broadleaves and Grasses	Dacthal, EPTAM 6-E, Treflan
Beets	Annual Broadleaves and Grasses	Pyramin, Betanal
Broccoli Cabbage	Annual Broadleaves and Grasses	Vegedex, Dacthal, Treflan, Planavin
Cantaloupe Cucumber	Annual Broadleaves and Grasses	Vegedex, Alanap-3, Treflan,

Crop	Weeds Controlled	Herbicide
Carrots	Annual Broadleaves and Grasses	Stoddard Solvent, Chloroxuron
Lettuce	Annual Broadleaves and Grasses	Balan, Vegedex
Okra	Annual Broadleaves and Grasses	Karmex, Treflan, Planavin
Onions	Young Annual Broadleaves and Grasses	Dacthal, Stoddard Solvent, Sulfuric Acid
Peas, Peppers	Annual Broadleaves and Grasses	Treflan, Dymid, Enide, Stoddard Solvent, MCPB
Potatoes, Irish	Annual Broadleaves and Grasses	Dymid, Enide, DCPA
Potatoes, Sweet	Nutsedge	Eptam 6-E, Vernan
Squash	Annual Broadleaves and Grasses	Vegedex
Tomatoes	Annual Broadleaves and Grasses	Dymid, Enide, Treflan, Dacthal

PASTURE AND FORAGE CROPS

Perennial Grass Pastures and Meadows	Broadleaves	2, 4-D Amine, 2, 4-D Volatile Ester
	Bullnettle	2, 4-D Amine
Perennial Grass-Legume Pastures	Broadleaves in White-clover-Grass Mixtures	2, 4-D Amine, 2, 4-DB Amine, 2, 4-D Ester
Temporary Winter and Summer Pastures and Hay Crops of Annual Grasses	Broadleaves	2, 4-D Amine
Bermuda	Crabgrass and Some Other Annual Grasses and Broadleaves	Simazine, 2, 4-D Amine, 2, 4-D Ester
	Broadleaves	2, 4-D Amine
Alfalfa	Seedling Broadleaves	2, 4-DB Amine, 2, 4-DB Ester
	Cool Season Broadleaves, Annual Grasses-Crabgrass, Sandbur, Colorado grass	2, 4-D Amine, Dalapon

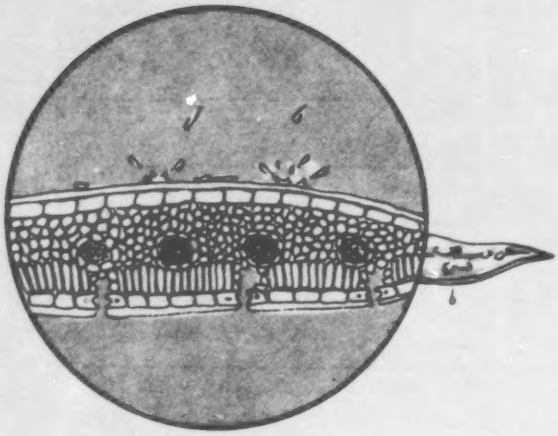
CHEMICAL MIXTURE AND APPLICATION OF CERTAIN CROPS

	COTTON
Annual grasses	Varying rates of Diuron depending on the time of treatment and soil type. Treflan can be applied at 1/2-2 pounds per acre in 5-40 gallons of water sandy soils require lower rates.
Annual grasses, Johnsongrass, broadleaves, and nutsedge	.8 - 1 lb. Cotoran and 1.5 - 2 lbs. DSMA or 1 - 1 3/4 MSMA in 40 gallons water and 1.6 pint surfactant per acre post-emergent when weeds are less than 3" tall and cotton is from 6" tall and before first bloom.
Johnsongrass	3.5 - 5 lbs. Dowpon in 20 gallons water plus 1/2 pint surfactant per acre post-emergent to weeds before planting cotton.
	SORGHUM
Annual broadleaves	1 - 2 lbs. Atrazine in 10 - 40 gallons water by ground or 2 - 5 gallons water by air plus 1 pint surfactant for each 25 gallons water post-emergent.
Annual broadleaves, grasses	1 - 3 lbs. Propazine in 10 - 40 gallons water by ground or 1 1/2 - 5 gallons by air per acre pre-emergent.
Broadleaves	1/2 - 1 lb. 2, 4-D Amine in 2 - 10 gallons water by ground or 1 - 5 gallons water by air per acre after crop is 6" tall but before flowering.
	PEANUTS
Brachiaria, crabgrass, colorado grass, pigweed, carpetweed, Purslane	3/4 lb. Balan in 30 - 40 gallons water per acre pre-emergent. 3/4 lb. Diphenamid in 30 - 40 gallons water or granular per acre pre-emergent (Brachiaria often not controlled). 3 - 4 lbs. Diphenamid and 1 1/2 lbs. Dinoseb in 30 - 40 gallons water per acre when a majority of peanuts are cracking the ground.
Nutsedge, small seeded annual grasses, annual broadleaves	2 1/2 lbs. Vernam in 30 - 40 gallons water per acre pre-emergence. Does not control brachiaria or Colorado grass.

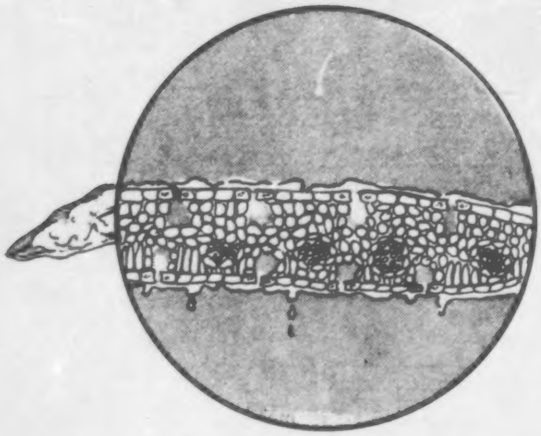
	WHEAT, BARLEY, AND OATS
Annual winter broadleaves	1/2 lb. 2, 4-D Ester in 5 - 10 gallons water by ground or 2 - 5 gallons water by air per acre after full tiller but before jointing.
Annual broadleaves	1/2 - 1 lb. 2, 4-D Ester in same amount of water as above. Apply during soft dough stage only as emergency measure to permit harvest.
	RICE
Annual broadleaves	3/4 - 1 lb. 2, 4, 5-T Amine in 20 - 40 gallons water by ground or 4 - 10 gallons by air per acre when rice is in late tillering and before jointing or panicle development.
Most annual grasses and many annual broadleaves when treated while young	3 lbs. Propanil in 10 - 40 gallons water by ground or 8 - 10 gallons water by air per acre when grasses have 3 - 4 leaves. Fields should be flooded 3 - 4 days after treatment. Do not use if Sevin has been used as an insecticide.
Barnyard grass	3 lbs. Molinate granules per acre into flood after grass has emerged from soil but before it is 3" tall.
	FLAX
Grasses and broad-leaved annuals	1/4 lb. MCPA and 5 lbs. Sodium TCA in 10 - 20 gallons water per acre when weeds are small and flax is 2 - 6" tall.
Annual broadleaves and grasses	1.6 - 3.2 lbs. Diuron in 50 - 75 gallons water per acre pre-emergent to weeds. Use only in citrus established at least 1 year.
Johnsongrass and other established annual grasses	Up to 10 lbs. per acre per year in varying amounts of water. Spray to wet foliage of actively growing plants 8 - 12" tall.
	BEANS AND SWEET POTATOES
Annual broadleaves grasses and nut-sedges	EPTC, 2 - 3 lbs. for beans; 4 - 7 1/2 lbs. for sweet potatoes, in 30 - 40 gallons water pre-emergence or pre-transplant, incorporate 2 - 3".
	BEETS
Annual broadleaves and grasses	4 - 5 lbs. Endothall in 30 - 40 gallons water pre-emergent. Incorporate 1".
	Cabbage, Broccoli, Cauliflower, Brussel sprouts, Cantaloupe, Cucumber, Greens, Lettuce, and Squash.
Annual broadleaves and grasses	CDEC -- 2 - 6 lbs. for 1, 2, 3, 4, and 9; 2 - 4 lbs. for 5, 6, 7 and 8 all in 30 - 40 gallons water incorporated from 1/4 - 1" into soil. Plant below incorporation depth.

	CARROTS
Young annual broadleaves and grasses	1 - 2 lbs. Linuron in 30 - 40 gallons water post-emergent after carrots are 3" tall. Never use wetting agent. 40 - 100 gallons Varsol pre-emergent to crop. Apply to weeds 1 - 3" tall at night or on cool day.
OKRA, PEAS, PEPPER, TOMATOES	
Annual broadleaves and grasses	Treflan -- 3/4 - 1 lb. for 1; 1/2 - 3/4 for 2, 3, and 4 all in 30 - 40 gallons water incorporated 1" pre-emergence or pre-transplant.
	ONION
Young annual broadleaves and grasses	6 - 8 lbs. Dacthal in 30 - 40 gallons water pre-emergent to crop. Do not incorporate. 40 - 80 gallons Varsol pre-emergent to crop when weeds are small.
	WATERMELONS
Annual broadleaves and grasses	3 - 6 lbs. Bensulide in 30 - 40 gallons water pre-emergent. Incorporate 1", plant below treated zone.
	PASTURE AND FORAGE CROPS
Broadleaves	1 lb. 2, 4-D Amine in 15 - 20 gallons water when weeds are young and growing on perennial pastures lower rate to 1/2 - 3/4 lb. for grass-legume pastures. On temporary summer or winter pastures use 1/2 lb. in 15 - 20 gallons water after crop is established or tillered.
Broadleaves, crabgrass, and some other annual grasses	On Bermuda grass 1 1/2 - 2 lbs. 2, 4-D Amine in 25 - 40 gallons water pre-emergent to weeds, or when young broadleaves are growing rapidly.
	RANGELAND
Bitterweed, bitter sneezeweed, carelessweed, cocklebur, common broomweed, croton, Russian thistle, ragweed, snow on-the-mountain	1 lb. 2, 4-D low volatile ester in 15 - 25 gallons water in areas receiving less than 30" rainfall. Use 2, 4-D Amine in areas receiving more than 30" rainfall. Treatment should be in spring when moisture conditions are good and young weeds are growing vigorously.

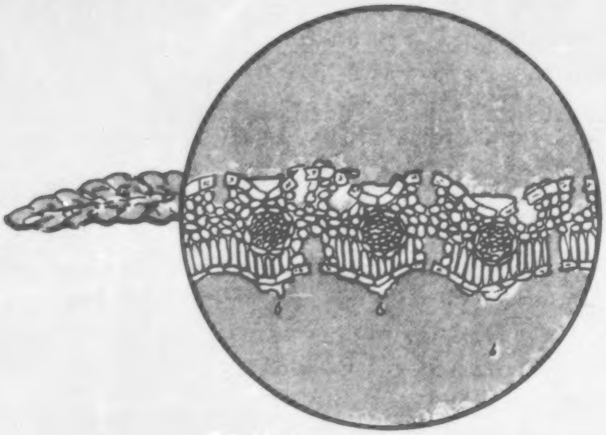
Problems in Effective Herbicide Use



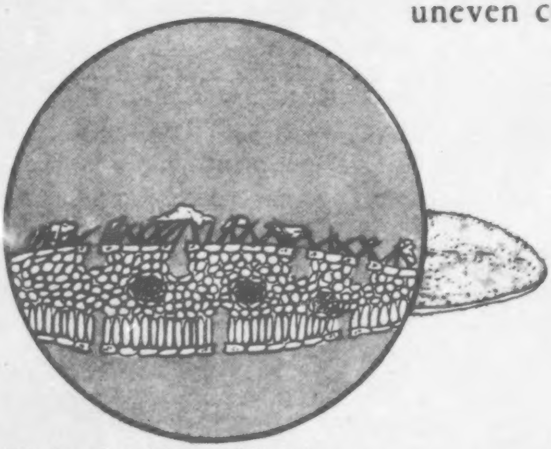
Spray splashes and runs off waxy leaves.



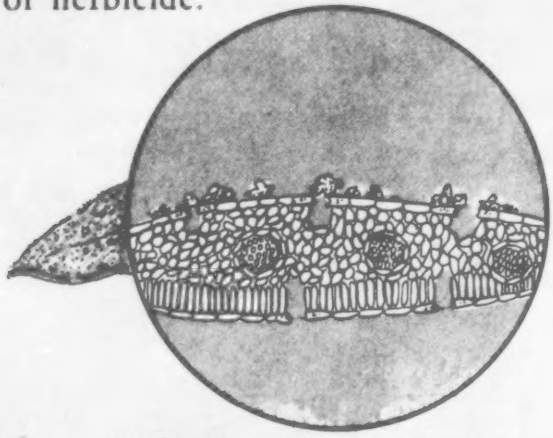
Poor absorption of herbicide caused by small stomata.



Corrugated leaves cause uneven coverage of herbicide.



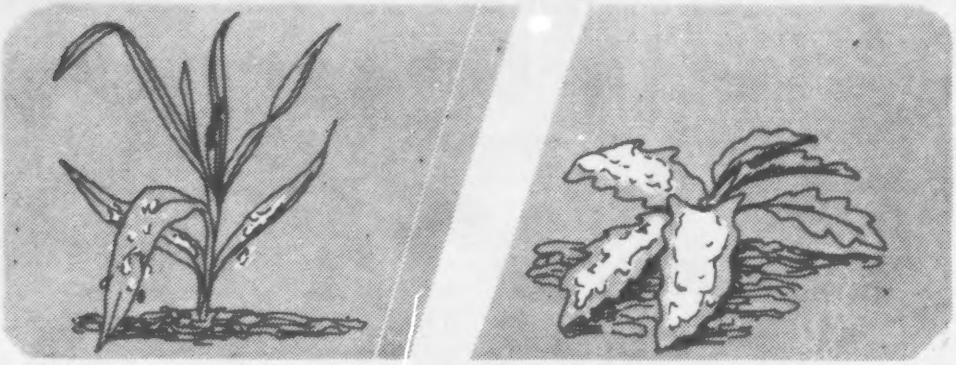
Hairs hold herbicide away from leaf surface.



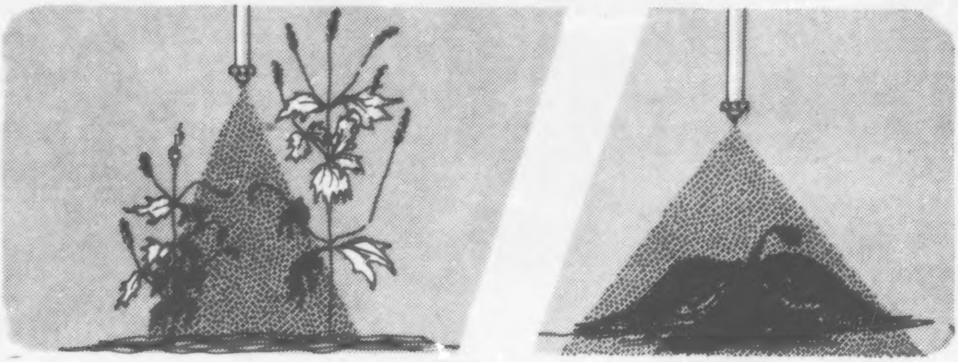
Lack of a wetting agent causes slow absorption of dry herbicides.

Problems in Effective Herbicide Use

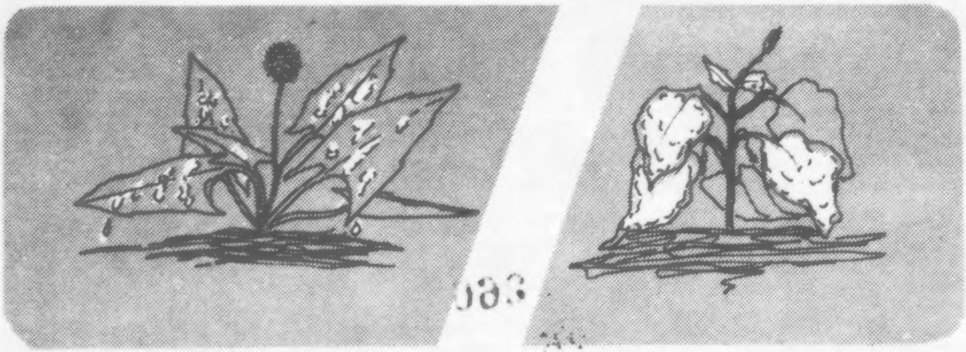
Some sprays will roll off upright leaved plants and will adhere only to horizontal leaved plants.



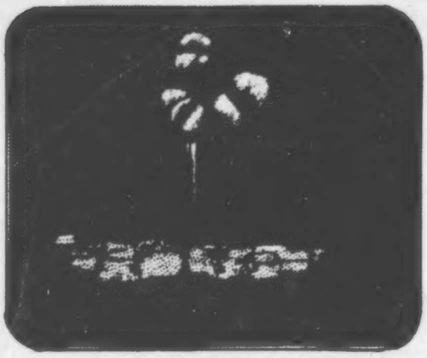
Partial coverage of leaf surfaces is ineffective in killing weeds.



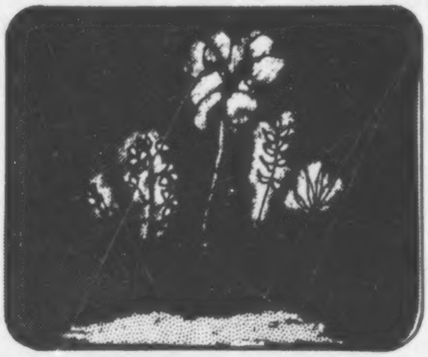
Surfactants are chemicals that cause sticking spreading and penetration of the herbicide.



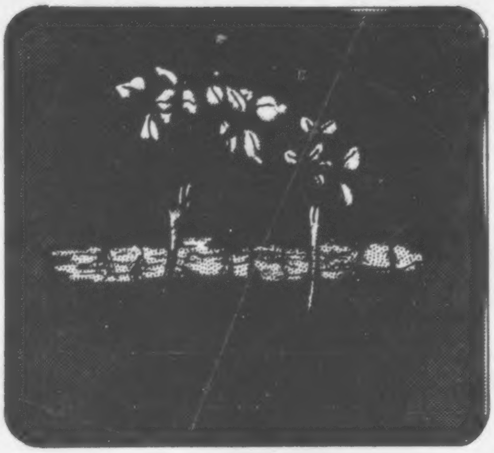
Problems in Effective Herbicide Use



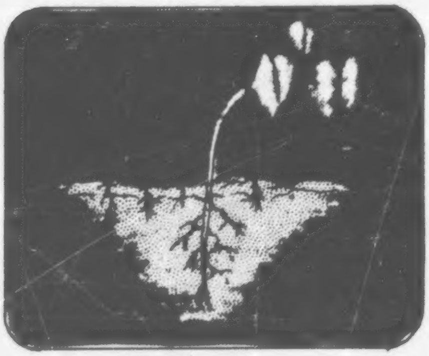
Weeds die when herbicide is carried to the root zone.



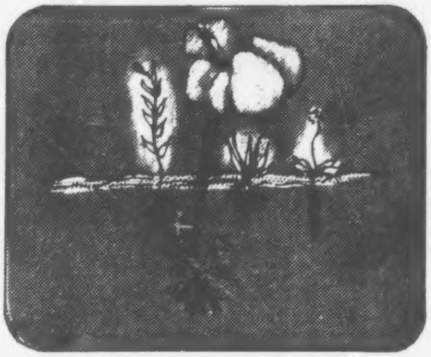
Weeds live when water carries the herbicide too deep.



Crop seeds planted below the herbicide zone survive because roots develop below the herbicide.



Herbicide kills crop and weeds when placement is wrong.



Weeds live when their roots are not touched.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

EFFECTIVE USE OF HERBICIDES

Plants with upright and narrow leaves are usually more difficult to kill than plants with broad leaves. The spray has less tendency to bounce off the broad leaf plant.

Some plants have the ability to translocate herbicides; whereas others do not permit the herbicide to move from the point of penetration to other plant parts. Sprayers should be adjusted to place the herbicide on the entire plant.

The following problems are encountered when spraying the various kinds of weeds:

> Waxy leaf surfaces may cause the spray to bounce off the leaves.
>
> Some plants have less stomata openings than others; therefore, the herbicide absorption rate is reduced. Large stomata openings permit good absorption of the herbicide. Weeds are usually killed more easily if the herbicide reaches the protoplasm through the stomata.
>
> Wetting agents in herbicides cause the chemicals to spread over the leaf surface.
>
> Spray bounces off corrugated leaf surfaces to form droplets. It spreads on noncorrugated leaves.

SOILS AND HERBICIDES

Most pre-emergence herbicides are suggested for use on specific soil types such as the following: sandy loams, silt, and clay loams (medium to moderately fine to heavy textured respectively). Only certain herbicides are to be used on sands and loamy sands, and occasionally a herbicide is suggested to be used on clays.

Herbicide application rates are based on the following considerations: (1) soil texture, (2) soil organic matter, (3) size and condition of the crop, and (4) size and condition of the weeds.

MIXING HERBICIDES

The product label will always state the amount of active ingredients in the formulation, either as a percent by weight or as pounds equivalent per gallon of liquid. Most herbicide recommendations are given as pounds of material per acre. A simple formula for calculating the amount needed for a given rate is as follows:

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

If 2 pounds of active ingredients is recommended per acre and if a 50 percent wettable powder is purchased,

$$\frac{2 \text{ lbs./acre} \times 100\%}{50 \text{ percent}} = 4 \text{ lbs. of the 50 percent product is required per acre.}$$

Following this formula, mix the 4 pounds of the wettable powder in the suggested amount of water to spray one acre.

If a 4 pound per acre active ingredient is recommended and if a 4 pound per gallon liquid is purchased,

$$\frac{4 \text{ lbs./acre active ingredient}}{4 \text{ lbs. per gallon product}} = 1 \text{ gallon of product is required.}$$

Mix one gallon in suggested amount of water to spray one acre.

In many instances only narrow bands are sprayed. For example, if spraying a 10-inch band on 40-inch rows, spray 1/4 as much as if spraying broadcast. Instead of one acre as shown in the examples, one and two, one would be able to spray 4 acres. When banding, the calculations should be made in terms of the area treated and not per acre of crop.

SPRAYERS USED TO APPLY HERBICIDES

There are three main types of herbicides. They are: (1) liquid, (2) granular, and (3) gas or volatile liquid.

The placement of nozzles is most important when using post-emerge herbicides. The nozzles should be on extensions so the spray is directed at a level below the bottom leaves of the crop and high enough to thoroughly wet weeds. This is extremely critical since severe crop damage may result if the spray gets on the cultivated plant. This type of placement nozzle is referred to as a directed spray.

A low-volume sprayer will apply wettable powders and emulsifiable concentrates at broadcast rates of 10 to 40 gallons per acre. However, a jet agitator should be used when working with wettable powders. Basically, all low-volume sprayers consist of a pump, tank, pressure regulator, pressure gauge, feed and return hoses, and delivery nozzles. Line and nozzle strainers are included to reduce pump damage and nozzle stoppage.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

Some general specifications of sprayer components are:

Pump	Tank	Agitator	Pressure Regulator
Minimum capacity 5 gal. per minute at 40 psi, 500 rpm, broadcast spraying 4 or more rows, 10 gal. per minute at 40-50 psi, 500 rpm	Oversized filler and drain plugs to facilitate cleaning. Match capacity to volume applied per acre. Tank materials: Stainless steel, aluminum, aluminum alloy, and fiberglass	Types: Mechanical Hydraulic a. Bypass - oil emulsions b. Jet - wettable powders	Types: Ball-spring Spring Diaphragm

Pressure Gauge	Hoses	Nozzles	Strainers
Range - 0 - 100 psi graduation increments - 5 psi	Synthetic rubberlined - resistant to aromatic solvents	Types: fan even spray, flooding, boomless, nozzle material: bronze, or brass, and stainless steel	Wettable powders 20-50 mesh oil emulsion or oil 100 mesh

Calibration of sprayers is a very important step, and probably the most important step in the application of herbicides. The first step is reading and following all directions on the package. Chemical manufacturers and distributors have information on calibration of sprayers, but two methods of calibrating sprayers are as follows:

1. All calibration methods are expressed as pounds and are designed to determine accurately the volume of spray discharged per acre. Recommended procedures for sprayer calibration involve the following basic steps:

   (1) Determine tractor ground speed.
   (2) Select a nozzle or nozzles to meet spray discharge requirements based on tractor speed, gallons per acre, and nozzle spacing.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

(3) Collect a measured volume of spray in a specific time period.
(4) Prepare tank mix based on active ingredient rate per acre and gallons of spray per acre.

2. This procedure can be performed very easily. First, attach all equipment that will be used to the tractor. Second, measure 300 feet down a row, then with equipment in the ground as if in actual farming, determine the amount of time it takes to travel the 300 feet. Then be certain to mark the throttle and gear setting. Third, substitute the actual number of seconds used to travel 300 feet in the following formula to determine mph (miles per hour).

$$\text{mph} = \frac{204}{\text{seconds to travel 300 feet}}$$

Example: Travel 300 feet in 51 seconds $\frac{204}{51} = 4$ mph

3. In order to select the correct nozzle needed, determine the spray delivery from each nozzle in gallons per minute. Find the desired speed, width of nozzle spacing, and gallons per acre (gpa) with the following formula:

$$\text{gpm (gallons per minute) per nozzle} = \frac{\text{gpa x mph x w}}{\text{5,940 (constant)}}$$

4. Nozzle pressure should be between 20 to 40 psi (pounds per square inch) for weed control. Select nozzles which will deliver the right amount of spray at a pressure less than 40 psi. If the sprayer is already equipped with nozzles that will not spray the gpa desired, the tractor speed can be changed to get the desired gpa, or the correct nozzles can be purchased to allow the right pressure. The formula for the number of seconds to collect a quart (32 ounces) of the spray mixture is:

$$\text{seconds/quart/nozzle} = \frac{\text{15 (constant)}}{\text{gpm per nozzle}}$$

5. With the tractor running out of gear, at the previously selected throttle setting, adjust the pressure regulator so that each nozzle delivers one quart in the required number of seconds.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

6. Following the nozzle manufacturer's specifications, adjust height and direction of nozzles so that the patterns overlap properly in boom spraying, band spraying, or boomless, broadcast spraying.

7. If the tractor driver changes speed or changes pressure, the sprayer must be recalibrated. Also, the nozzles will wear and frequent recalibration is necessary to compensate for nozzle wear.

8. After calibrating, mix herbicide in the tank according to directions, then add the correct amount of carrier.

9. Some examples for calibrating sprayers using above methods are:

   (a) Boom spraying, broadcast. Spray 30 gpa at 5 mph with a 20 inch nozzle spacing on the boom.

   $$\text{gpm per nozzle} = \frac{30 \times 5 \times 20}{5{,}940} = 0.51$$

   gpm per nozzle = 0.51, select an 80° or 95° flat spray nozzle to deliver 0.51 at suggested psi.

   $$\text{seconds/quart/nozzle} = \frac{15 \text{ (constant)}}{\text{gpm per nozzle}}$$

   $$\text{seconds/quart/nozzle} = \frac{15}{.51} = 29.4$$

   (b) Band spraying with one nozzle. Gpa is the amount applied to the area actually treated. If a 40 gpa rate is applied at 4 mph on a 14-inch band, the 40 gpa would be used with 4 mph on a 14-inch band width in the formula given below.

   $$\text{gpm per nozzle} = \frac{40 \times 4 \times 14}{5{,}940} = .38$$

   gpm per nozzle = .38, select an 80° or 95° even spray nozzle to deliver .38 gpm at suggested psi.

   $$\text{seconds/quart/nozzle} = \frac{15}{.38}$$

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Information Sheet continued)

$$\text{seconds/quart/nozzle} = 39.5$$

(c) Band spraying with 2 or more nozzles per band. If two nozzles are used to spray the 40 gallon acre rate on a band, calibrate by substituting 20 gpa in formula (a), page 31. Using the width of the band sprayed by one nozzle, collect the quart from one nozzle in the time calculated with formula (a), using constant 15.

(d) Boomless spraying broadcast. Spray 20 gpa at 4 mph and cover a 40 foot swath (40 feet x 12 inches).

$$\text{gpm per nozzle} = \frac{20 \times 4 \times 40 \times 12}{5{,}940} = 6.5$$

gpm per nozzle = 6.5, select a single assembly of nozzles to deliver 6.5 gpm at suggested psi.

(e) Spraying at a broadcast rate above 40 gpa. Spray 50 gpa at 4 mph with nozzles spaced 20 inches apart on the boom.

$$\text{gpm per nozzle} = \frac{50 \times 4 \times 20}{5{,}940} = .67$$

gpm per nozzle = .67, select 80° or 95° flat spray nozzles to deliver .67 gpm at suggested psi.

The time in seconds to catch one gallon from each nozzle may be determined by this formula:

$$\text{seconds/gallon/nozzle} = \frac{60\ \text{(constant)}}{\text{gpm per nozzle}}$$

$$\text{seconds/gallon/nozzle} = \frac{60}{.67} = 89.6$$

GRANULAR HERBICIDE APPLICATORS

Companies selling granular applicators have guide books along with their operators' manuals and these are usually reliable.

SOIL INJECTORS

These injectors are used for the highly volatile herbicides, and several things should be considered when applying these herbicides:

a. Ground must be free of trash.

b. The soil must seal over the furrow made by the injector. (Otherwise the chemical will be lost and weed control reduced.)

c. Moisture must be right for scouring of injector units.

d. Injectors are calibrated the same as other liquid sprayer units.

e. Follow recommendations of chemical formulator precisely in setting injector units.

SOIL INCORPORATION EQUIPMENT

Some herbicides must be mixed thoroughly with the soil in order to give satisfactory results, but these are so described on the label. The following group of implements can be satisfactorily used as incorporators and the amount of incorporation one will get is explained.

a. Incorporate power-driven equipment to full depth of cut; it should be 2 to 3 inches deep most of the time.

b. Other types of units usually incorporate at a depth 1/2 of the cut. Ground-driven hoes and rolling cultivators cannot be used at a field speed in excess of 4 to 6 miles per hour. (Be careful to avoid plant damage.) In coarse soils, the ground-driven equipment will mix to the full depth of cut if the soil is dry.

c. In broadcast applications on flat ground, all incorporation equipment, except power-driven equipment, should be used twice. The ground-driven equipment should cut only deep enough to cover the herbicide when putting it down. The second time over, the depth should be the same as stated before, 2 to 4 inches.

OTHER VERY IMPORTANT CONSIDERATIONS

a. Check on the selectivity of a particular herbicide before using it. Some herbicide selectivity for crops is based on the placement of the herbicide and not the herbicide itself.

b. Post-emergence herbicides have advantages and disadvantages. The main advantage is that the farmer can wait and see what his weed problem is going to be, then treat accordingly. The main disadvantage is that extra trips will have to be made through the field to apply the herbicide.

c. Pre-emergence herbicides have one distinct advantage; they can be put on immediately before planting, during planting, or immediately after planting. In most cases, the sprayer is attached to the planter, thus reducing the number of trips through the field. The main disadvantage is that the farmer may not know exactly what his weed problems will be in the future.

d. Clean equipment thoroughly after each use and never use 2, 4-D or 2, 4, 5-T in equipment that is used to spray other broad-leaf crops. Herbicides are extremely hard to clean off equipment.

CALIBRATION FORMULAE

$$\text{mph} = \frac{\text{204 (constant)}}{\text{seconds to travel 300 ft.}}$$

Example - Travel 300 ft. in 51 seconds.

$$\frac{204}{51} = \text{4 mph (tractor ground speed)}$$

Band Spraying One Nozzle

$$\text{gpm per nozzle} = \frac{\text{gpa} \times \text{mph} \times \text{w}}{\text{5,940 (constant)}}$$

Example - 40 gallons per acre x 4 mph x 14 inch band width

$$\text{gpm per nozzle} = \frac{40 \times 4 \times 14}{5{,}940} = .38$$

$$\text{seconds/quart/nozzle} = \frac{\text{15 (constant)}}{\text{gpm per nozzle}}$$

Seconds required to collect 1 quart spray at the nozzle $= \frac{15}{.38} = 39.5$

Use a 80° or 95° flat nozzle.

Band spraying 2 nozzles, use 20 gpa.

CALIBRATING EXAMPLES

Boom Spraying, Broadcast

Spray 30 gpa at 5 mph with nozzle 20 inches apart.

$$\text{gpm per nozzle} = \frac{30 \times 5 \times 20}{5{,}940} = 0.51$$

80° or 95° flat nozzle output is 0.51 of suggested psi.

$$\text{seconds/quart/nozzle} = \frac{15}{.51} =$$ 29.4 or 1 quart collected from each nozzle in 30 seconds.

Boomless Spraying, Broadcast

Spray 20 gpa at 4 mph over 40 ft. swath (40 ft. x 12 in.)

$$\text{gpm per nozzle} = \frac{20 \times 40 \times 4 \times 12}{5{,}940} = 6.5$$

Single assembly of nozzles delivers 6.5 gpm at suggested psi. May adjust to 6 gallons per minute.

Spray Broadcast Above 40 gpa

Spray 50 gpa at 4 mph nozzles 20 inches apart.

$$\text{gpm per nozzle} = \frac{50 \times 4 \times 20}{5{,}940} = .67$$

$$\text{seconds/quart/nozzle} = \frac{60 \text{ (constant)}}{.67} =$$ 89.6 or 1 gallon sprayed from each nozzle in 90 (89.6) seconds.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Insect and Pest Control

TOPIC: Safety

OBJECTIVE: To acquaint the student with the methods of handling pesticides safely and to know first aid practices to follow in case of accidents.

REFERENCES:
Required:
1. Information Sheet, "Safety".

QUESTIONS OR ACTIVITIES:

1. What agency of the Federal Government classifies the use of pesticides?
2. How does the Texas Department of Agriculture and the EPA control the use of pesticides in the state?
3. Where can specific information be obtained on pesticide poisoning and therapy?
4. Briefly explain how chemicals may be safely stored.
5. List and explain the two ways that pesticides are taken into the body.
6. List four major types of pesticides and give their uses.
7. List some important clothing that should be worn when using or handling pesticides.
8. What are the three major chemicals that may cause poisoning?
9. What is a safe way to prevent a pesticide spill from spreading?

Information Sheet
for
SAFETY

Generally agricultural chemicals can be classed as safe chemicals if handled, stored, and used as recommended. If the user of chemicals fails to read the labels on containers or to follow instructions by the manufacturer, then the chemicals may become dangerous to the life and health of the user, other people, and animals.

Chemicals most commonly used for agricultural purposes are classified as pesticides, (insecticides, herbicides, fungicides, and rodenticides) and fertilizers. Other types of agricultural chemicals include: plant regulators, defoliants, desiccants and antibiotics. The following pesticides are used for:

Insecticides - Used to prevent, repel, or destroy insects affecting humans, animals, and plants.

Herbicides - Used to prevent, repel, or destroy weeds.

Fungicides - Used to prevent, repel, or destroy fungi.

Rodenticides - Used to control rats, mice, gophers, and other harmful rodents.

There have been several major changes in federal and state laws regarding the use of pesticides since the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) was first passed in 1947. This act has been amended twice, in 1972 and 1975. In 1972 it was amended by the Federal Environmental Pesticide Control Act. This act is administered and enforced by the Environmental Protection Agency (EPA).

Pesticides sold, offered for sale, distributed or delivered for transportation, or transported within the state must be registered with the Texas Department of Agriculture and the EPA. Federal registration applies within the state, but additional state and local restrictions may exist.

Federal law requires EPA to classify each use of a pesticide as either "restricted" or "general," based on considerations of potential hazard to the applicator or other persons and the possibility of unreasonable adverse effect on the environment. A federally restricted-use pesticide may be used only by or under the direct supervision of a certified applicator as explained in Topic 1, 'Importance of Weed Control". The state may further restrict additional uses to certified

UNIT: Insect and Pest Control
TOPIC: Safety
(Information Sheet continued)

commercial and noncommercial applicators or impose other restrictions. General use is the use of pesticides which will not cause excessive damage to the environment or endanger the applicator or other persons when applied according to label directions.

The meaning of the term toxicity when referring to pesticides is: it is the degree of the poisonous effect to warm blooded animals. A pesticide label may be identified by the word Danger (highly toxic), Warning (moderately toxic), or Caution (low toxicity). The label of a highly toxic pesticide will show a skull with crossbones and carry the word "Poison" which is printed in red. The ways toxic materials are taken into the body are:

> Oral - The poison is taken into the body through the mouth where it later passes to the digestive system. Oral exposure may be avoided by:
>
> > Keeping pesticides in the proper containers with the proper label.
> > Wait until the safety interval has passed before eating anything (vegetables, etc.) that has been sprayed. Post a sign in the vegetable area showing when it is safe to eat the produce.
> > Thoroughly wash the hands and face with soap and water before eating.
> > Refrain from smoking, chewing gum, or eating snacks while working with pesticides.
> > Do not use the mouth to clean the low pressure nozzles or other parts of the equipment.
>
> Dermal - Actually absorbing pesticide through the skin can be more dangerous than taking it through the mouth. Absorption can take place when mixing, applying, or just handling a pesticide. It can also enter the skin by using contaminated clothing, drifting of dust or spray, and entering an area where reentry interval has not expired. Prevention of dermal exposure is:
>
> > Eliminate splashing, spills, drift, reentry, and reuse of contaminated clothing and many dermal exposure problems are eliminated.
> > Wear the proper type of clean clothing each day. Wash the tractor cushion if it becomes contaminated. It may even be necessary to change clothing more than once per day if the clothes become contaminated due to splashing or drift.
> > Use below 50 psi when spraying and apply when the wind is less than 3 1/2 miles per hour.

Inhalation - Inhalation exposure can be more dangerous with certain types of pesticides than others. Pesticide spray particles, vapors, and dust can be inhaled very easily under certain conditions. The three most common ways to inhale pesticides are smoking tobacco that has become contaminated, breathing smoke from burning pesticide material, and being in the drift during spraying or dusting. The ways to prevent inhalation exposure are:

Use a chemical cartridge respirator that is equipped with dust filters and gas absorbing canisters.
Refrain from smoking when working with pesticides and do not burn pesticide trash.
When spraying or dusting operate the unit so that the drift will move away from the body, and do not spray or dust when the wind is above 5 miles per hour.

Some type of protective clothing should be worn when using or handling pesticides. Two types of clothes that are considered to give the best protection are water-repellent and coveralls that are heavy enough to keep out the pesticide. Always wear a long sleeve shirt. Coveralls should be changed daily. Complete clothing includes:

Goggles - Wear goggles when handling pesticides. This includes mixing and loading. Use the unvented and nonfogging type. If a full face respirator is used, goggles are not needed.

Gloves - Always use gloves when handling pesticides. Use long unlined rubber gloves. They can be washed easily. Use natural rubber gloves when handling organophosphates.

Aprons - Wear a plastic or rubber apron long enough to cover the rubber boot tops when either mixing or loading pesticides. Rubber aprons should be used when mixing or loading organophosphates.

Boots - Wear rubber boots when mixing, handling, and walking through freshly sprayed areas. Trouser legs should cover the boot tops.

Respirators - Respirators are to protect against breathing pesticides. A gauge respirator can be used to filter out dust and spray particles. Cartridge respirators protect against gases and dust. Use a full-face respirator when working with highly toxic pesticides and working in close places. The respirator should be rinsed with soap and water after use.

Three major types of agricultural chemicals that may cause poisoning and symptoms of these poisonings are as follows:

ORGANOPHOSPHATES	CARBAMATES	CHLORINATED HYDROCARBONS
Irreversible Cholinesterase Inhibitors	Reversible Cholinesterase Inhibitors	CNS Depressant/ Stimulant
Azodrin (monocrotophos) Bidrin (dicrotophos) Cygon (dimethoate) Di-Syston (disulfoton) Dylox (trichlorfon) Diazinon - Difonate EPN - Ethion Guthion (azinphos) Malathion - Naled Methyl Parathion - Parathion Phosdrin (mevinphos) Systox (demeton) Thimet (phorate)	Baygon (propoxur) Furadan (carbofuran) Lannate (methomyl) Sevin (carbaryl) Temik (aldicarb) Zectran	Aldrin - BHC Dieldrin - Endrin Lindane Mirex - Thiodan Toxaphene The exact mechanism of action of these chemicals is nt known. In general they act on the central nervous system to stimulate or depress, varying by compound. Repeated doses may affect liver and kidney functions.
SYMPTOMS OF POISONING		
1. MILD - headache, dizziness, weakness, anxiety, miosis, impairment of visual acuity.	Constriction of pupils. Salivation. Profuse sweating. Lassitude.	(Twenty minutes to four hours) Nausea. Vomiting. Restlessness.

UNIT: Insect and Pest Control
TOPIC: Safety
(Information Sheet continued)

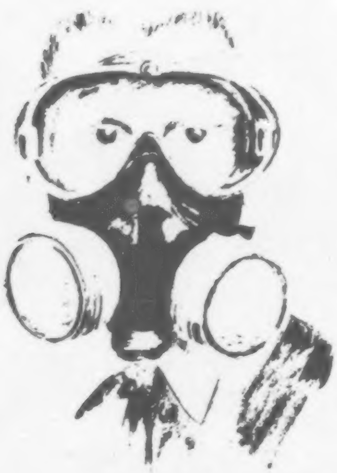
2. MODERATE - nausea, salivation, lacrimation, abdominal cramps, vomiting, sweating, slow pulse, muscular tremors.	Muscle incoordination Nausea. Vomiting. Diarrhea. Epigastric pain. Tightness in chest.	Tremor. Apprehension. Convulsions. Coma. Respiratory failure.
3. SEVERE - diarrhea, pinpoint and non-reactive pupils, respiratory difficulty, pulmonary edema, cyanosis, loss of sphincter control, convulsions, coma, and death.		Death. DO NOT INDUCE EMESIS IF THE INGESTED POISON IS PRINCIPALLY A HYDROCARBON SOLVENT (e. g., kerosene).

First aid procedures recommended for some types of exposure include:

Eyes Affected - Wash the eyes by flushing with running water for about 15 minutes. Use low pressure and call a doctor.
Skin Affected - Remove clothing and shoes. Wash the skin with soap and water. Use plenty of water. Call a doctor.
Swallowed Pesticide - Check the type swallowed. It may be that the patient should be forced to vomit. Call for medical help immediately. If material is caustic or has a hydrocarbon solvent, vomiting must not be introduced. Use label instructions.
Inhaled Pesticide - Have patient placed in fresh air. Keep patient quiet and warm. Loosen clothing and check for normal breathing. If breathing stops, apply artificial respiration. Get medical help immediately.

In case specific information is needed on pesticide poisoning and therapy, one of the poison control centers listed on the following page may be contacted.

THREE BASICS OF PESTICIDE SAFETY

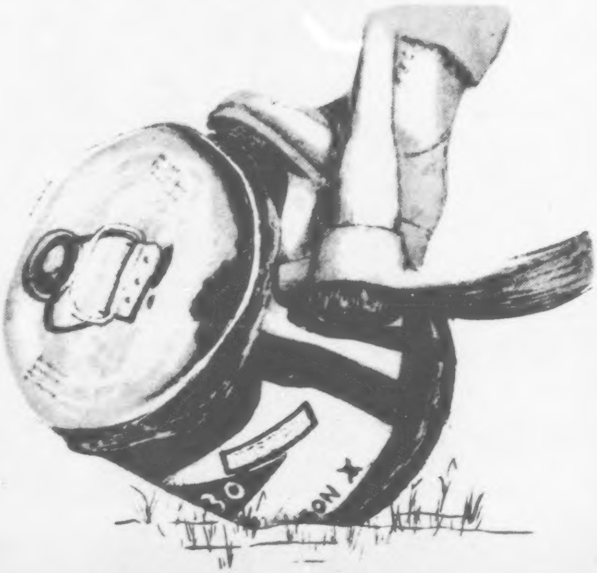


Protect Yourself!

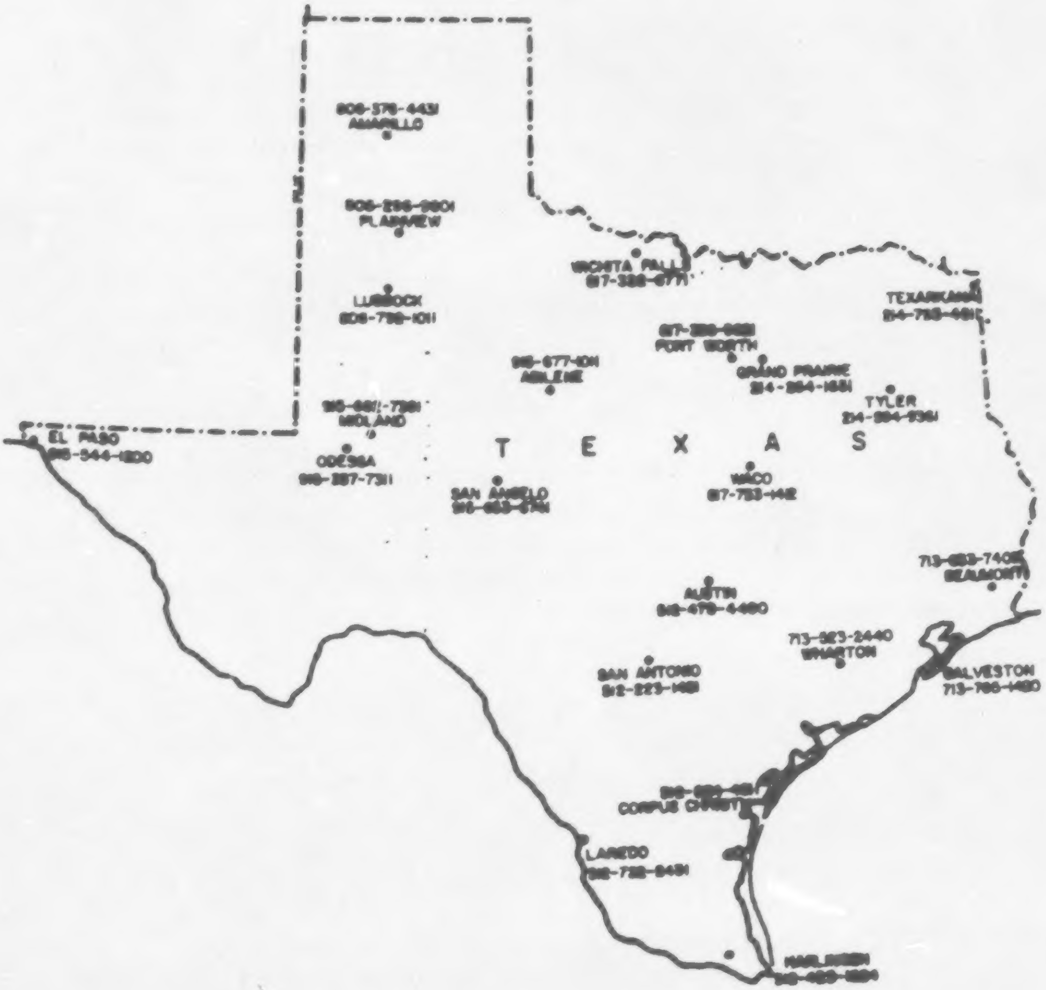
Know the Pesticide!

ATROPHINE
SULFATE
USP
1/100G.
POISON

Dispose Properly to Avoid Contamination!



UNIT: Insect and Pest Control
TOPIC: Safety
(Information Sheet continued)


806-376-4431
AMARILLO
806-296-9601
PLAINVIEW
LUBBOCK
806-792-1011
WICHITA FALLS
817-322-6771
817-336-6611
FORT WORTH
GRAND PRAIRIE
214-264-1651
TEXARKANA
214-793-4611
TYLER
214-597-0351
915-677-1011
ABILENE
915-684-7381
MIDLAND
EL PASO
915-544-1200
ODESSA
915-337-7311
T E X A S
SAN ANGELO
915-653-6741
WACO
817-753-1412
713-833-7409
BEAUMONT
AUSTIN
512-478-4490
713-532-2440
WHARTON
SAN ANTONIO
512-223-1481
GALVESTON
713-765-1420
512-884-4511
CORPUS CHRISTI
LAREDO
512-722-2431
HARLINGEN
512-423-9004

UNIT: Insect and Pest Control
TOPIC: Safety
(Information Sheet continued)

Always store chemicals in the original containers, with the label attached, and the lid closed tightly. Using soda pop bottles, fruit jars, or other types of containers can have serious consequences. Small children associate various shaped containers with their original contents and may be injured or killed by careless use of containers. Never leave excess pesticide mixtures in unmarked containers.

Keep all chemicals out of the reach of children, pets, and irresponsible people. Do not store them in your home near food. This will help reduce the exposure hazard and also prevent possible contamination of food. Lock all chemicals in a building or cabinet. The lock should keep everyone out of the chemicals except those who are qualified to use them properly. Children are always curious. Remember, anything they can get their hands on may be put in their mouths.

Special care must be taken to see that corrosive materials are stored and handled in containers designed for such materials. A corrosive material in the wrong kind of container may eat through the container and be wasted or cause serious damage.

Chemicals in glass bottles should not be stored near heat. Since many chemicals must be stored in glass containers, it is necessary to be especially careful. Glass containers can break or explode, spreading the chemical over a large area. Store materials in glass containers in dry, cool areas. It is sometimes necessary to protect some of them from freezing, so that the labels should be checked carefully for proper storage information. Some pesticides contain flammable solvent; therefore, fire prevention methods must be observed.

To be sure that the label remains on the container and in readable condition, protect it with transparent tape or lacquer if the chemical is to be stored for a long period. Remember, the label is the most important safety factor in the use of agricultural chemicals. Do not let it become damaged or destroyed.

Stroe different types of pesticides (insecticides, herbicides, fungicides, and rodenticides) in separate locations. Store powder and granular pesticides on shelves to keep them from caking and free of soil moisture. Caked material is very difficult to mix and it requres more handling. Some pesticides may require warm locations during the winter months due to freezing temperatures altering the chemical makeup.

(CAUTION: Do not store weed killers, herbicides, or defoliants in the same room with insecticides. Volatile materials such as 2, 4-D and its derivatives can contaminate other pesticides. Chlorate salts can create a fire or explosion hazard.)

UNIT: Insect and Pest Control
TOPIC: Safety
(Information Sheet continued)

Protective clothing should always be worn when cutting out the plastic seal in the pouring spout or removing the bung or other outlet cover on a pesticide container. No portion of the body should be placed directly over the seal or the pouring spout. The release of pressure may cause the liquid to spew from the container. When pouring from a can with a spout, the spout should be positioned at the top of the can to prevent an uneven flow of liquid and consequent splashing. Use a large container so that it is not over full and will spill when emptying it in a spray tank. When mixing pesticide it is recommended that a portion of the water or solution be added before adding the amount of poison needed, then add the remainder of water. The skin and eyes can be protected when using chemicals by practicing the following safety procedures:

Wear a long-sleeved shirt and long pants.
Button shirts at neck and wrists and wear inside pants.
Wear a wide-brimmed hat.
Wear waterproof boots.
Wear waterproof gloves that fit snugly around wrists.
Wear safety goggles.
Wear a rubber or plastic apron.
Wear a respirator when using dust or wettable powder.

Proper disposal methods help reduce and eliminate the hazard of contaminating the water, soil, and air and endangering both plant and animal life by exposing it to various chemical poisons. The most common types of chemical materials that require special disposal methods are: empty containers, leftover chemicals, spilled chemicals, and rinse or cleaning materials used in applicators. Regardless of the method used, the amount of hazard can be lessened by:

1. Buying only the amount of pesticide needed for the season.

2. Mixing only as much pesticide as will be needed for a particular job.

3. Rinsing empty containers about three times and pouring the rinse into a spray tank.

4. Keeping lids and bungs tightened at all times when containers are not being used.

5. Keeping all empty containers in a secure storage area until they can be properly disposed of safely.

UNIT: Insect and Pest Control
TOPIC: Safety
(Information Sheet continued)

Large metal and some plastic containers may be disposed of most safely by returning them to the supplier or selling them to a firm equipped to handle toxic materials. Pesticide containers can also be safely disposed of locally at public dumps, incinerators, or private disposal sites.

When using a public dump or incinerator, notify the operator of the dump or incinerator of the nature of the material so that he will be able to take any necessary precautions. Before leaving the disposal site, remove lids and bungs, break glass containers, and chop holes in the top, bottom, and sides of metal containers with a sharpened pickax. Breaking and puncturing containers will make it less likely that an unauthorized person will remove them from the dump and attempt to convert them to other uses. Containers should be buried at public dumps.

If suitable public facilities are not available and containers cannot be returned to a supplier or sold to a cooperage firm, a disposal site should be selected that will be used only for surplus pesticide and pesticide containers. It should not be an area that might later be returned to cropland or some other use. Pesticides should be buried at least 18 inches deep. It should be away from homes, wells, streams, crops, and livestock. Level ground is best because the residue will be absorbed through the soil and lessen the chance that it will be carried away in water runoff. Do not locate the site on the watershed of a public water supply or where livestock have access to it. Pesticides can contaminate wells if spilled or poured from applicators or containers near this type of facility. Some pesticides may even poison the grass where livestock graze if applied under over-application conditions or if equipment is rinsed in the area.

Pesticide spills can be very dangerous to livestock. A liquid spill should be kept from spreading by using a small border around the spill area and applying an absorbent material (lime and sawdust). Usually the pesticide can be picked up in the absorbent material and buried at least 18 inches deep in the soil.

An incinerator for burning small containers can be constructed from a 55-gallon drum. One end of the drum should be removed and holes punched in the sides, leaving room at the bottom of the drum to hold the fuel. Fuel oil or used crankcase oil will provide complete combustion and be safe to use if it is handled carefully. This is for noncombustible materials. If burning of materials is permitted in the locality, burnable containers may be destroyed by pouring crankcase oil over them before lighting the fire. Pesticide containers containing dangerous chemicals

UNIT: Insect and Pest Control
TOPIC: Safety
(Information Sheet continued)

should not be burned if the smoke is allowed to drift. Weed killer containers should not be burned if the chemical contained 2, 4-D.

Remove clothing that has been contaminated with insecticides and then bathe immediately. Wash hands and face after dusting or spraying before eating.

Carefully rinse empty containers with water and detergent (see table below). Allow water and detergent to remain in the container for 15 minutes with intermittent agitation. Pour rinsing into a pit dug in sandy soil.

Re-rinse container for another 15 minutes with the same amount of water and detergent. Again pour rinse solution into the pit.

Container Size	Water	Detergent
5 gallons	2 quarts	2 tablespoons
30 gallons	3 gallons	1/2 cup
55 gallons	5 gallons	1 cup

Clean the sprayer after each use. Many chemicals are corrosive; some are in suspension and will settle out and harden if left standing. Drain and flush the tank with clear water. Disassemble the nozzles, strainers, and screens. Wash with kerosene using an old toothbrush or other soft-bristled brush or compressed air. Coat the threads with cup grease or pipe compound to prevent joints from "freezing". Before reassembling, pump clear water through until sprayer is clean. Sprayer requires special cleaning after spraying weed control chemicals.

Procedure to follow in cleaning the sprayer after using 2, 4-D and related chemicals:

Clean out spray material.

Soak all pieces of spray equipment in a 1 percent solution of household ammonia. (1 gallon of ammonia to 100 gallons of water or 2 teaspoons per quart of water) Rinse sprayer several times with clear water.

CAUTION: Even after this thorough cleaning, the sprayer should not be used to spray plants such as tomatoes or grapes which are susceptible to chemicals.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Insect and Pest Control

TOPIC: Definition and Classification of an Insect

OBJECTIVE: To develop the ability to properly classify, define, and identify insects.

REFERENCES:

Required:

1. Information Sheet, "Definition and Classification of an Insect".

QUESTIONS OR ACTIVITIES:

1. What percentage of farm production is destroyed by insects?
2. What is an insect?
3. An insect's body is divided into three sections. What are they?
4. Name 3 ways insects may be classified.
5. What type of damage do chewing insects do?
6. What type damage do sucking insects do?
7. Name 3 ways insects may be beneficial.
8. Name five beneficial insects.

Information Sheet
on
DEFINITION AND CLASSIFICATION OF AN INSECT

Insects are important competitors with man for food and fiber; however, there has been phenomenal progress in insect control in recent years. A quarter of a century ago it was estimated that insects destroyed approximately 25% of farm production, compared to today's figure of 12% of a much higher agricultural output.

Controlling insects has been a constant battle for man since the beginning of time. Because of man's need for large quantities of food and the insect's ability to multiply in large quantities, the battle seems to be a never ending one. If unchecked, a pair of flies can produce 191,010,000,000,000,000,000 offspring from April to August.

An insect is defined as any one of a number of small boneless animals, including ants, bees, flies, boll weevils, bollworms, aphids, and a multitude of others, whose bodies are divided into three sections or body regions. These sections are:

Head - Bears one pair of antennae and mouth parts.

Thorax - Bears three pairs of legs and often bears wings.

Abdomen - Has as many as eleven segments but never bears legs.

Insects may be classified in different ways. Three ways in which they are classified are: (1) According to the way they feed on plants, (2) as harmful or beneficial, and (3) by order.

When classified according to the way they feed on plants, insects are known as either chewing or sucking insects.

Chewing Insects - This group bites off, chews, and swallows plant parts. Colorado potato beetles, blister beetles, peach tree borers, armyworms, cutworms, grasshoppers, and cotton bollworms are examples of chewing insects. The most common kinds of chewing insects are grasshoppers, beetles, and caterpillars.

Sucking Insects - This group either rasps or pierces the epidermis (outer layer) of the plant and sucks sap from the cells. Aphids, often called plant lice, plant bugs, leaf hoppers, chinch bugs, thrips, squash bugs, mealy bugs, and scales, are examples of sucking insects. Butterflies and moths are siphoning insects; wasps and bees are chewing - lapping insects; thrips are rasping - sucking insects.

UNIT: Insect and Pest Control
TOPIC: Definition and Classification of an Insect
(Information Sheet continued)

Some of the chewing-type insects are classified as internal feeding types, and some of the chewing and sucking are classified as being subterranean types.

Internal Feeding Insects - Insects of this group are the chewing type, which enter the plant and feed from within. The European corn borer, cotton boll weevil, and corn earworm are examples.

Subterranean Insects - This group includes both chewing and sucking insects, as well as gall insects and root borers, which attack the plant below the soil surface. The corn root worm, wireworms, and white grubs are examples.

Insects may also be classified as being harmful or beneficial.

Harmful Insects - Throughout the day and night multitudes of harmful insects are chewing, sucking, biting, and boring away at our crops, as well as our homes, livestock, and ourselves. The pests do untold injury, reduce yields, lower the quality, and increase the cost of production by requiring outlays for equipment and materials for control measures.

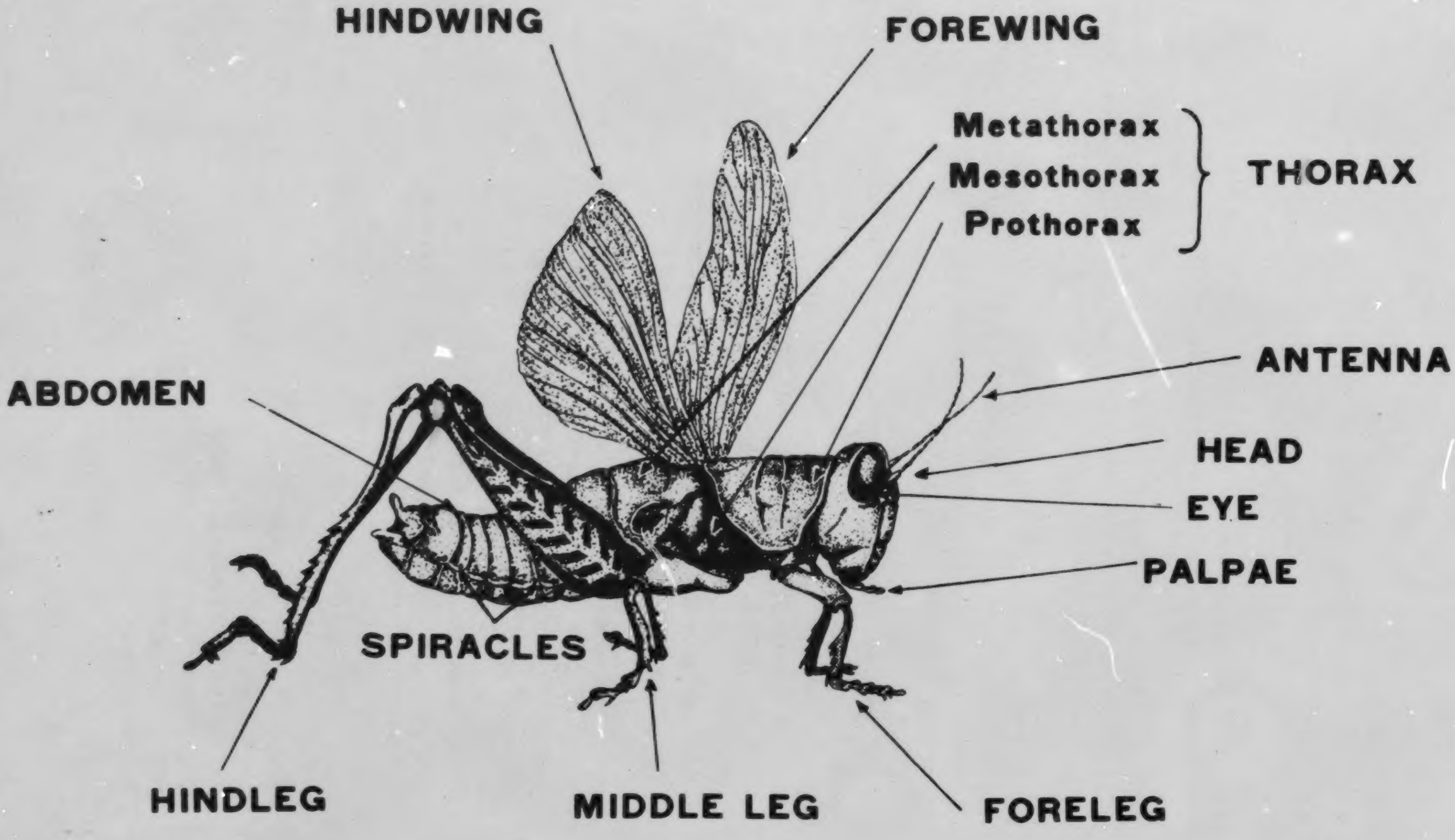
Beneficial Insects - "Friends" of Man - While many insects are harmful to man, plants, and animals, there are also a host of others which serve in beneficial capacities. There are ways in which several of the "friendly" insects are beneficial:

Some insects improve soil.
Some insects are indispensable as pollenizers of plants.
Some destroy harmful insects.

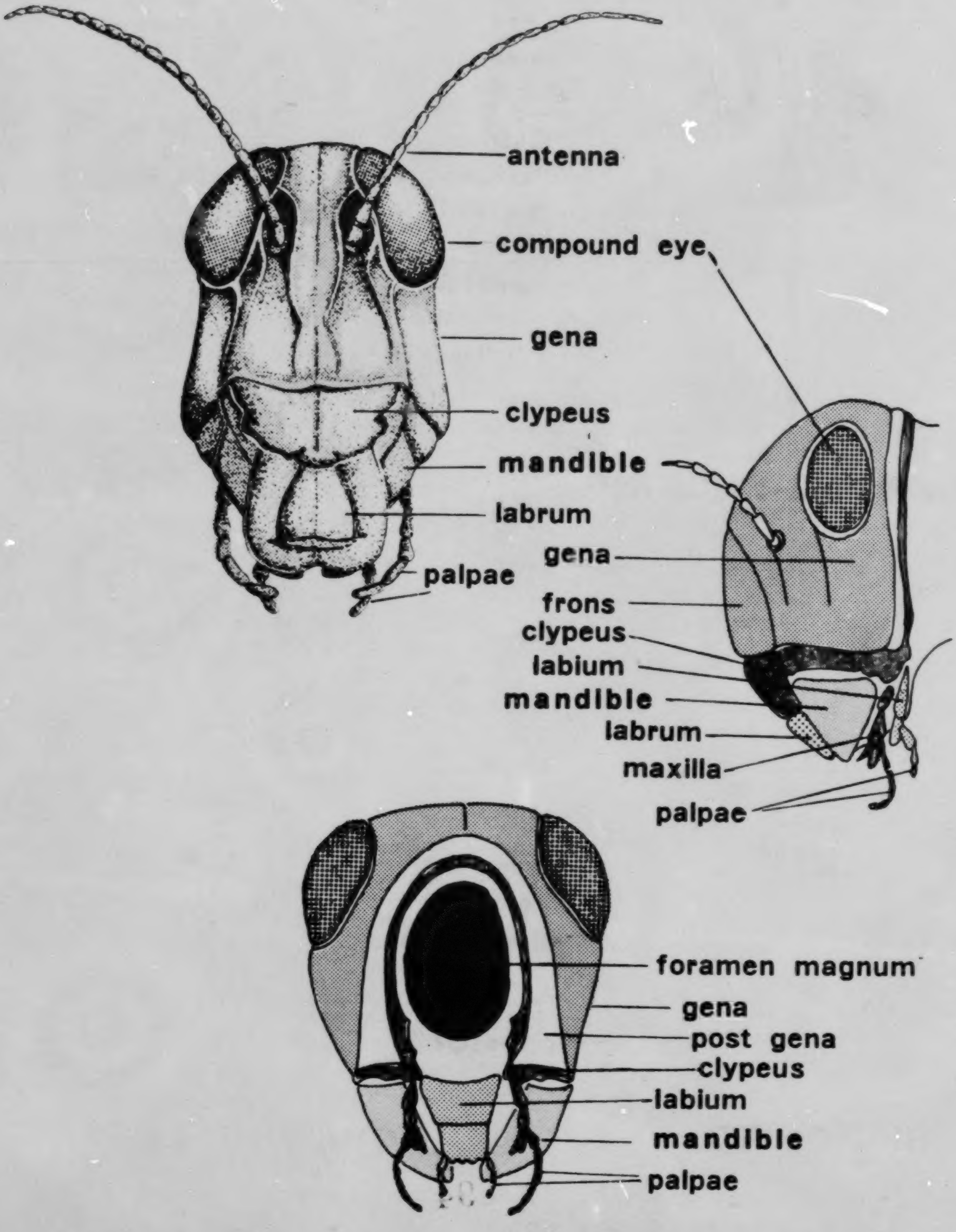
Insects are also classed by orders. Some of the most common orders are:

Coleoptera - beetles, weevils
Hemiptera - leaf bugs
Lepidoptera - butterflies, moths
Orthoptera - grasshoppers
Homoptera - aphids
Thysanoptera - thrips

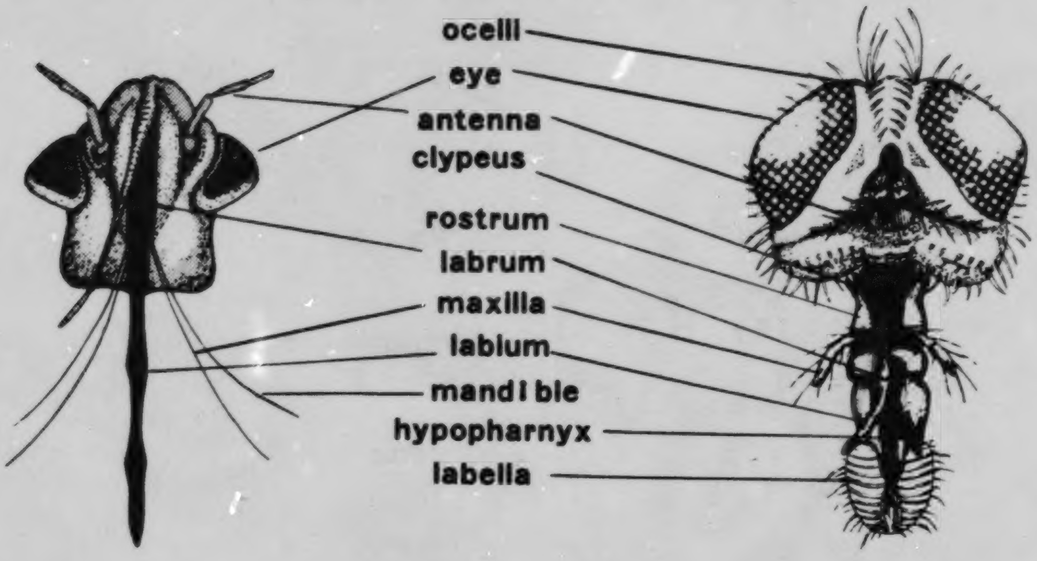
BODY PARTS OF THE INSECT


HINDWING
FOREWING
Metathorax
Mesothorax
Prothorax
THORAX
ANTENNA
ABDOMEN
HEAD
EYE
PALPAE
SPIRACLES
HINDLEG
MIDDLE LEG
FORELEG

CHEWING MOUTHPARTS


antenna
compound eye
gena
clypeus
mandible
labrum
palpae
gena
frons
clypeus
labium
mandible
labrum
maxilla
palpae
foramen magnum
gena
post gena
clypeus
labium
mandible
palpae

OTHER TYPES OF MOUTHPARTS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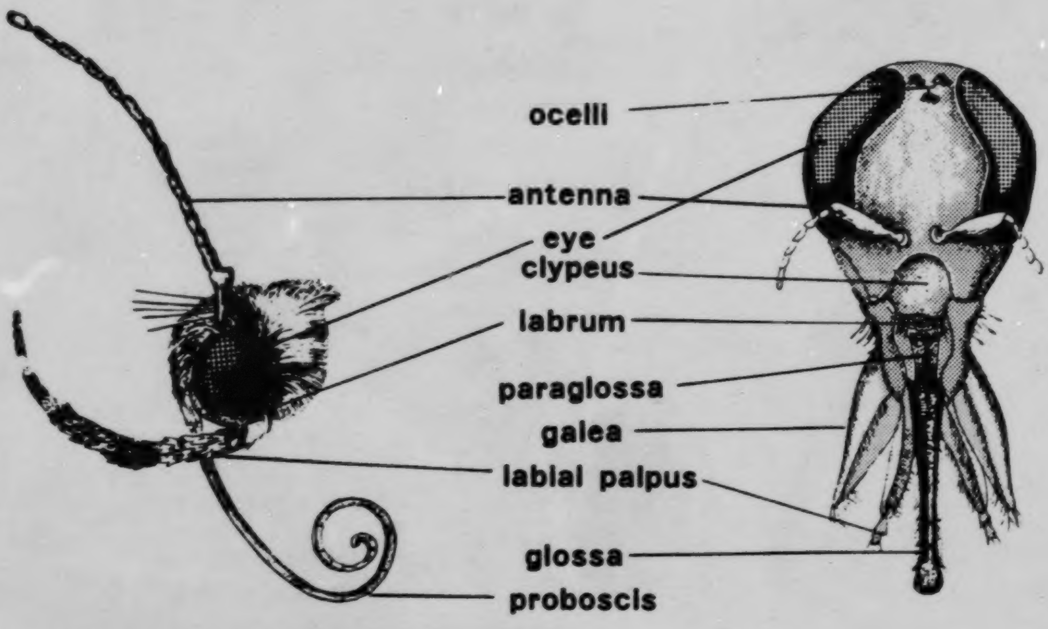
eye
antenna
clypeus
rostrum
labrum
maxilla
labium
mandible
hypopharnyx
labella

PIERCING-SUCKING

SPONGING

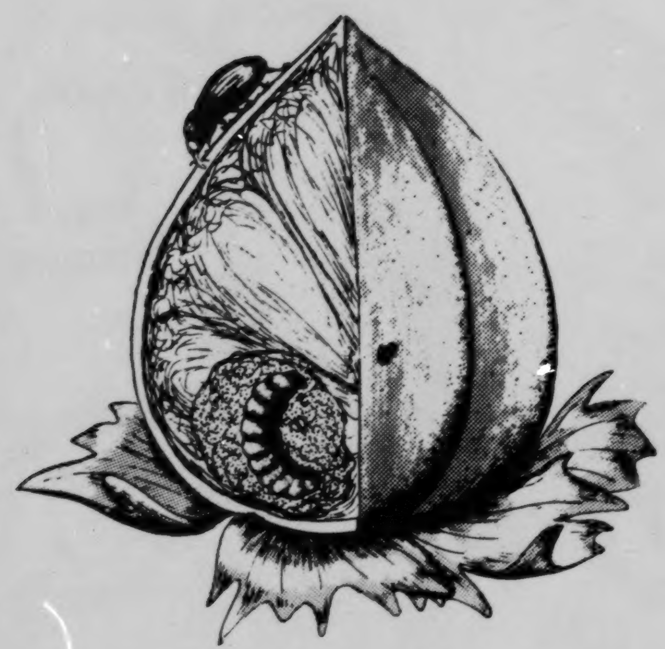

ocelli
antenna
eye
clypeus
labrum
paraglossa
galea
labial palpus
glossa
proboscis

SIPHONING

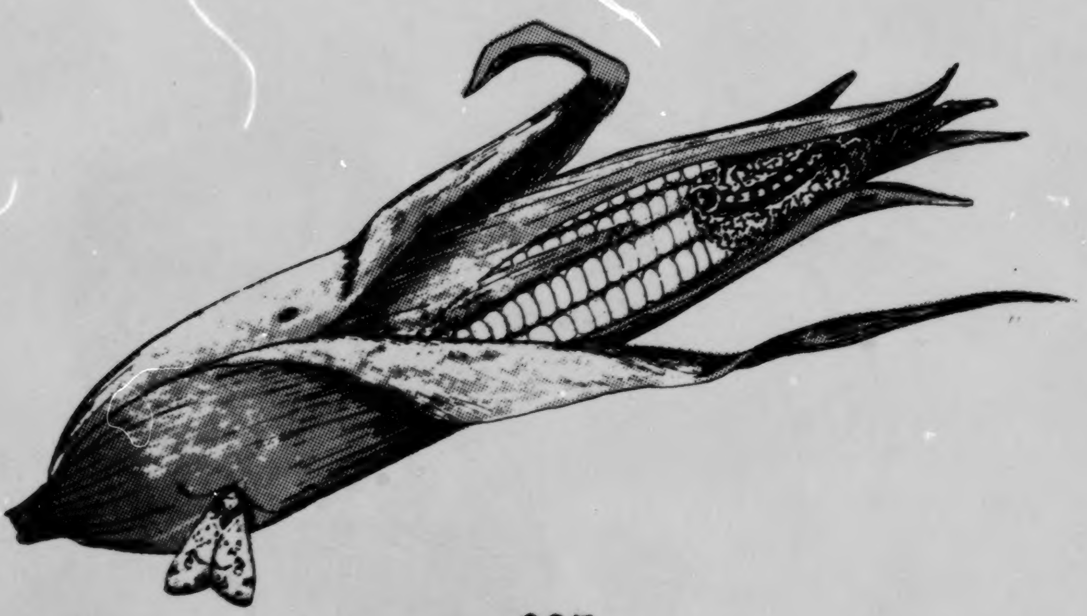
CHEWING-LAPPING

INSECT DAMAGE

Boll Weevil

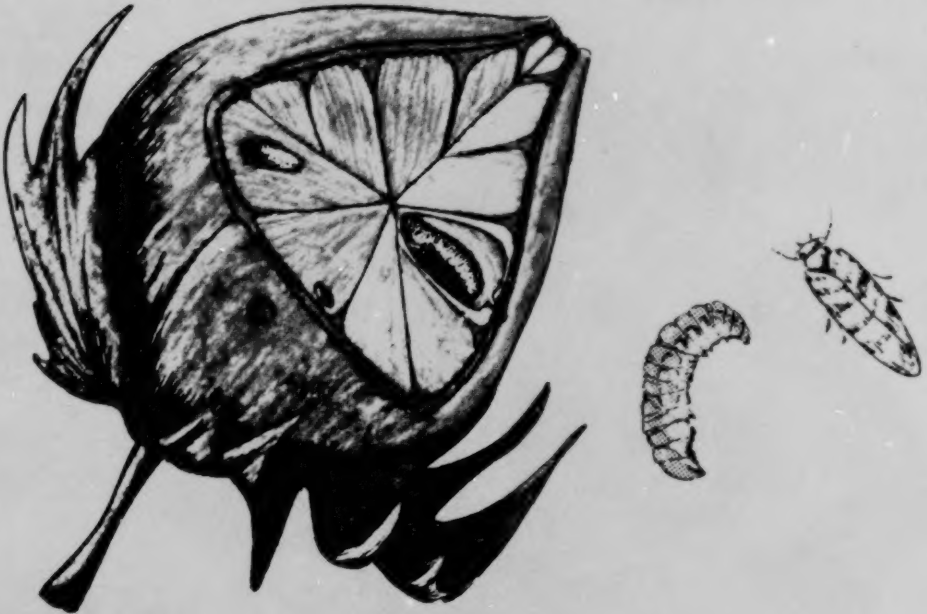


Corn Earworm

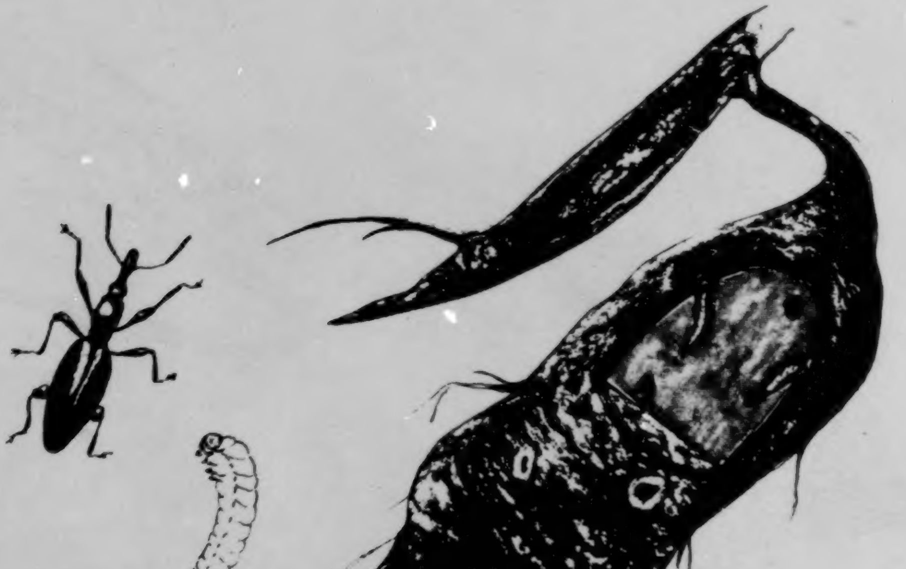


INSECT DAMAGE

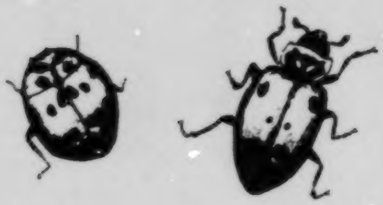
Pink Bollworm



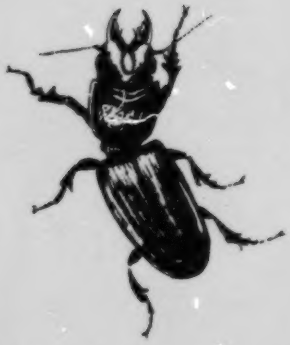
Sweet Potato Weevil



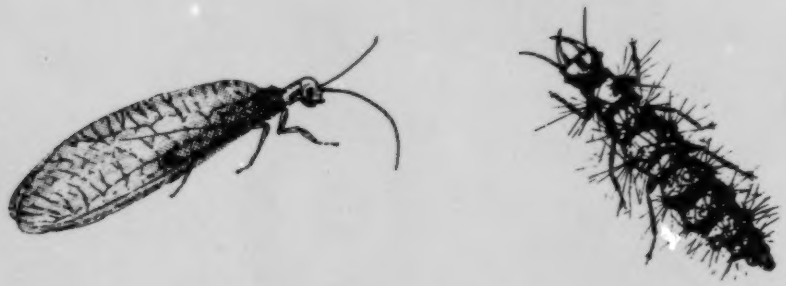
BENEFICIAL INSECTS AND SPIDERS



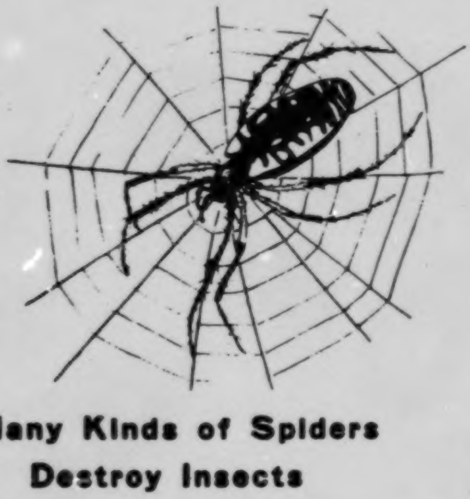
Lady Beetles Feed on
Aphids and Soft-bodied Insects



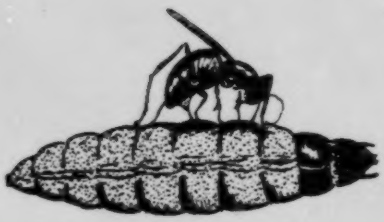
Ground Beetle and Larva
Feed on Insects



Lacewing Larva and Adult Larva (Aphid Lion) Feed on Aphids



Many Kinds of Spiders
Destroy Insects



Female of Bracon Hebator
Laying Eggs in Larva

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Insect and Pest Control

TOPIC: Management

OBJECTIVE: To develop an understanding of the economic factors, methods, and results of insect control.

REFERENCES:

Required:

1. Information Sheet, "Insect and Pest Management".
2. "Insects Attacking Forage Crops", B975, Texas Agricultural Extension Service.

QUESTIONS OR ACTIVITIES:

1. What is insect control?
2. What are the two kinds of insect control?
3. Which of the two kinds of control is the most important?
4. How can one tell when there is a need for insect control?
5. How many million dollars are spent annually for control measures to protect our food and fiber from insect damage?
6. It is estimated that food cost in the United States would rise how much if there were no insect control program?
7. Where can insect specimens be sent for identification?

Information Sheet
on
INSECT AND PEST MANAGEMENT

Plant Insect Control

What is plant insect control? It is generally regarded as anything that will kill. repel, and interfere with feeding, reproduction, and dispersal of insects.

Economic Factors of Plant Insect Control

Plant insect control by any method is costly, but it is estimated that about $704 million a year is being spent on chemical insect control. This amount is spent to protect only food and fiber crops. Comments are made every day that insecticides are harmful. Some may be, but without them, food would be scarce and the cost of food would increase as much as 50 to 75 percent. Not only would the cost of food be prohibitive, but the quality of the products would probably be inferior.

There are many other economic factors to be taken into consideration before any insect program is started. The main point to consider is that spraying for harmful insects also kills beneficial insects which may be necessary for pollination or to eat harmful insects. It is usually wise to avoid spraying a crop for insects until those insects reach sufficient numbers to cause damage to the crop. This will vary with the type of crop, particular pest on the crop, and the locality where the crop is being grown.

If a crop requiring pollination is sprayed for a harmful insect, bees or other pollinators will have to be brought in before the crop will produce. Every time you spray, more pollinators will be needed. Buying or renting pollinators is fairly expensive so this adds to the cost of insect control. Once an insect spray program is started, it must be continued until harvest or the crop matures, so it is wise to wait as long as possible to begin spraying. Usually, the earlier in the season that spraying begins, the more applications that will be required.

Methods of Control

NATURAL CONTROL

Nature limits the number of plants that will grow in order to keep everything in balance. Man has disturbed this balance of nature by increasing the population of plants, thus causing an increase in the other factors of natural control.

UNIT: Insect and Pest Control
TOPIC: Management
(Information Sheet continued)

Natural control usually comes under these four main groups:

1. Climatological
2. Physical
3. Predators
4. Diseases

Under certain circumstances each of these groups affect what will survive and thrive in any area and will also affect the balance of life in that area. Since man has disturbed nature because of the need for food, only the first two groups of natural factors limit his crop production. In other words, man has been able to alter the predators and diseases by various means of artificial controls.

CULTURAL CONTROL

Cultural control methods include such things as rotation of crops, tillage, planting dates, improved plant varieties, and keeping fields clean. If each is used correctly, conditions are made unfavorable for insects. For example, by planting crops as early as possible, the crop may have reached maturity before climatic conditions are favorable for insects.

Many examples could be given for each of the others, but the only purpose here is to recognize the importance of cultural practices in controlling or altering insect populations.

One extremely important area of cultural practice is most often overlooked, and that is the necessity of keeping the area around the fields clean. This is very important because most insects overwinter in crop residue or on weeds. If a particularly bothersome insect overwinters on a weed growing close to a field, the population of that insect will be reduced by removing the particular weed.

Before cultural practices can be very effective, a farmer should be familiar with the life-cycle of the insect. Then, the farmer can take the necessary steps to cause a break in the life cycle of the insect and reduce the insect population.

The main purpose of cultural control is to avoid an insect problem getting started, because it is usually cheaper to prevent something than it is to cure it.

UNIT: Insect and Pest Control
TOPIC: Management
(Information Sheet continued)

CHEMICAL CONTROL

Chemical control can be defined as the application of poisonous materials to control insects. This is generally thought of as an insecticide or pesticide, which is a poisonous chemical used to control plant or animal pests. Insecticides are compounds which are poisonous to insects: as such, they are usually classified according to the way they enter the insect's body and kill it.

The stomach poisons are materials eaten and digested by the insect. They kill primarly by being absorbed into the insect's body. The contact poisons are absorbed through the outside covering or "skin" of the insect and they will destroy the insect's nervous system. The fumigants are usually in the form of a gas which is fatal and when the insect breathes, the gas will kill him.

The stomach poisons are effective in controlling insects that chew; the contact poisons control all insects, especially sucking insects; the fumigants or gaseous insecticides control insects in grain storage bins.

All insecticides other than fumigants may be applied in different ways; some are used only as sprays, and some are used only as dusts.

Checking for Insect Damage

The main points to consider when checking fields for insect damage are:

1. Know what insects attack the crop in your locality.
2. Know what the insect looks like.
3. Know what damage the insect will cause to the plant and where this damage is located.
4. Know what the damaging levels of insect populations are.
5. Be able to check the life cycle of the insect.
6. Know where to find information regarding the correct control measures for the insect.

After you know all of these, proper control can be initiated at the appropriate time to break up the life cycle of the insect.

If a farm operator is unable to identify an insect that is apparently causing damage to a crop, he may submit the insect along with three copies of an insect identification form to The Extension Entomologist.

UNIT: Insect and Pest Control
TOPIC: Management
(Information Sheet continued)

INSECT IDENTIFICATION

Submit three copies of this form with the insect specimens. One copy will be returned to you with the identification and remarks, one will be sent to your county agent or district agent (whichever is applicable), and one copy will be retained for our files.

Collecting and Mailing Specimens

1. Place undamaged specimens and a paper label with your name and address into a vial of rubbing alcohol. The label should be typed or written in pencil because the alcohol will dissolve ink.
2. Pack the vial carefully to prevent breakage enroute.
3. Pack plants and plant parts to prevent crushing.
4. Mail the specimens and identification forms to EXTENSION ENTOMOLOGISTS AGRICULTURAL EXTENSION SERVICE, COLLEGE STATION, TEXAS.

Information

The following information is helpful in identification and is needed for our record.

Host ____________________ nearest town ______________ county ___________

Degree of infestation: light __________ moderate __________ heavy ____________

Distribution of infestation: local ___________ widespread over county __________

General remarks: (Insects per leaf, per plant, per animal; stage of plant growth, etc.)

Submitted by ______________________ Date ______________ Occupation ___________

Mailing Address ____

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Insect and Pest Control

TOPIC: Insecticides

OBJECTIVE: To develop an understanding of what pesticides are and the ability to use them properly.

REFERENCES:
Required:
1. Information Sheet, "Insecticides".

QUESTIONS OR ACTIVITIES:

1. What is a pesticide?
2. What is an insecticide?
3. What are 2 major methods of classifying insecticides?
4. What are 3 groups of insecticides according to how the insecticide enters the insect's body?
5. What are 3 groups of insecticides according to the chemical nature of the insecticide?
6. What are 8 major methods of formulating insecticides?
7. What are the 4 basic principles to follow in an insect control program?
8. What are the 3 basic principles of selecting, mixing, and applying insecticides?
9. How are insecticides applied?
10. What 4 things determine the amount of insecticide applied per acre?

Information Sheet
on
INSECTICIDES

A pesticide is a poisonous chemical used to control pests, either plant or animal. Insecticide is a poison that is used to kill insects.

Insecticides may be classified in several ways: the two major ones are by the way they enter the insect's body and by the chemical nature of the insecticide.

Insecticides which enter the insect's body are grouped three ways - stomach poisons, contact poisons, and fumigant poisons. Stomach poisons are digested by the insect. They kill primarily by action on or absorption from the digestive system and are most important for controlling chewing insects. Contact poisons are materials absorbed through the insect's skin or body wall and act on the pest's nervous system. For this to be effective, the insect must come into direct contact with the insecticide by crawling through it or by having it applied directly to its body. These poisons are usually effective in controlling sucking insects. Fumigant poisons enter the insect's body through the tracheal system in the form of a gas and are most effective in killing pests living in storage bins or other enclosures.

Since many of the insecticides today enter the insect's body in more than one way, classification may be clearer when based on the chemical nature of the insecticide. This method of classification includes inorganic poisons, organic compounds derived from plants, and synthetic organic compounds. Inorganic compounds are effective as stomach poisons. Insecticides of plant origin are most effective as contact poisons but may also be in the form of stomach poisons and fumigants. Synthetic organic compounds are predominantly contact poisons; however, they usually function as stomach poisons. Some may even possess fumigating or systemic poisoning properties.

Insecticides are most commonly formulated in the form of dusts, granular formulations, insecticide-fertilizer mixtures, wettable powders, solutions, emulsifiable concentrates, aerosols, or fumigants. Dusts are mixed with or impregnated on walnut shell flour, talc, pryophyllite, bentonite, or attapulgite. They are ground to 1 to 40 microns in size and will pass through a 325 mesh screen. The active material will range from 0.1 to 25 percent of the dust. Granular formulations are similar to dusts except for their size. Their size is referred to as 20/40 which means that most of the granules will pass through a .20 mesh screen and a negligible quantity will pass through a standard 60 mesh sieve. In the insecticide-fertilizer mixtures, usually granular insecticides have been added to commercial fertilizers or an insecticide has been sprayed directly onto the fertilizer. Wettable powders are like dusts in appearance; however, they are meant to be diluted and suspended in water and used as sprays.

UNIT: Insect and Pest Control
TOPIC: Insecticides
(Information Sheet continued)

They may contain as much as 75 percent toxicant. Solutions are materials which go into true solution. Water is used for some, but most organic insecticides must be dissolved in organic solvents. Emulsifiable concentrates consist of insecticide, solvent, and emulsifying agent,and oil-in-water is one example. These serve many purposes. Aerosols are composed of minute particles suspended in air as fog or mist. Particle size will range from 0.1 to 50 microns and may be dispersed in various ways. Fumigants are insecticides used in a gaseous form and are most often formulated as a liquid and held in a container under pressure. Upon release to the air, the liquid changes to a gas.

There are four basic principles of economical insect control. First, the crop should be frequently scouted or surveyed to determine the status of insect infestations. Second, the insects that need to be controlled should be identified. Third, cultural and natural control practices should be relied upon for control whenever feasible. Fourth, if insect infestations increase to the point that it is economically advisable to use chemicals to control them, the basic principles of selecting, mixing, and applying insecticides should be utilized. An insecticide that is effective against the insect or insects to be controlled should be selected. Carefully follow the directions on the container for mixing and safe handling of the insecticide. It should be applied at the right time, proper rate, and in the correct form to gain maximum effectiveness.

Ground machines or airplanes may be used for applying spray or dust insecticides. For best results with airplanes, flag the swaths so that they meet or overlap. Do not make spray applications when winds exceed 15 miles per hour and spray when plants are dry. When dusting, winds should not exceed 5 miles per hour. For broadcast-planted crops, No. 3 cone nozzles, set 20 inches apart on a rear-mounted boom of a tractor sprayer, have proved to be satisfactory. A pump pressure of 60 pounds per square inch (psi) is recommended. Nozzle size, number of nozzles, ground speed, and pressure influence the rate of output per acre; thus, the sprayer should be calibrated carefully to insure the application of recommended amounts of insecticides. One nozzle per row usually is adequate for young or small row crops. The use of two or three nozzles per row may be desirable on large plants to obtain adequate coverage.

Up to this point, nothing has been mentioned about insects' resistance to insecticides. For example, all tobacco budworms may have similar characteristics, but different types of poisons are used to destroy the budworm. Some species of budworms are more resistant to methyl parathion than other species of this same insect.

UNIT: Insect and Pest Control
TOPIC: Insecticides
(Information Sheet continued)

But what is resistance? This means that an insect pest will no longer be killed by an insecticide. Normally, resistance will not take place very rapidly, but it will depend upon the number of generations an insect may have during the year or growing season.

The following example may explain how resistance occurs. A field was sprayed with a chemical to control tobacco bud worms. Most of the worms received enough of the chemical to kill them quickly, but a few got enough chemicals to only make them sick. After a few days they were all right; then they pupated, and the adult moth formed. The adult would lay eggs, and they would hatch out. Then if the field was sprayed again, most of the worms would receive enough of the chemical to kill them, but a few more would live this time because it would require more of the chemical to kill them. This same cycle may be repeated thousands of times, but sooner or later a resistant strain of the insect will result and a new chemical will have to be used.

To add to the above example, the tobacco bud worm, which is a very serious pest in cotton, has shown considerable resistance to even the parathions in more recent years. Consequently, new insecticide formulations will have to be developed or, as the trend is now turning, more efficient and effective biological controls will be developed.

Many times populations of insects have been controlled by a combination of insecticides, but resistance may be developed to the combinations as well. If so, the farm operator should:

1. Rotate chemicals from year to year and not use the same chemicals too often.
2. Keep abreast of latest combinations of chemicals which affect control.
3. Start any insect control program with sound management.
4. Control breed hosts when possible.

UNIT: Insect and Pest Control
(Information Sheet continued)

INFORMATION ON SOME OF THE MORE IMPORTANT INSECTS DAMAGING PLANTS		
Insect	Adult Description	Crops Attacked
Alfalfa Caterpillar	Orange, Yellow Moth 2 Inch Wing Spread	Alfalfa, Occasionally Other Legumes
Alfalfa Webworm	Buff to Brown Moth 3/4 Inch Wing Spread	Alfalfa, Vegetables Clover, Soybeans, and Others
Armyworm	Moth, Brownish-Gray, 1 1/2 Inch Wing Spread	Corn, Grasses, and Many Other Plants
Armyworm (Fall)	Moth, Gray, White, or Dull Colored, 1 1/4 Inch Wing	Corn, Sorghum, Grasses, Tobacco, and Most Plants
Bean Weevil	Brownish-Gray Beetle, 1/8 Inch Long	Beans, Cowpeas
Chinch Bug	Soft-Bodied Bug, Black with White Wings with Spots on Them	Corn, Small Grains, Grasses
Corn Earworm	Moth, Yellowish-Green or Gray, 1 1/2 Inch Wing Spread	Corn, Cotton, Tobacco and Many Others
Corn Rootworm (Southern)	Beetle, Yellowish-Green or Gray, 12 Blackspots on Wing Covers, 1/4 Inch Long	Corn, Small Grains Cucumbers
Corn Root Aphid	Aphid, Bluegreen, Round, Winged, or Wingless	Corn, Cotton Several Weeds, Grasses
Cornstalk Borer (Southern)	Moth, White to Smoky Yellow, 1 1/4 Inch Wing Spread, At rest Wings Held Close, Making Acute Triangle	Corn, Sorghum Johnson grass

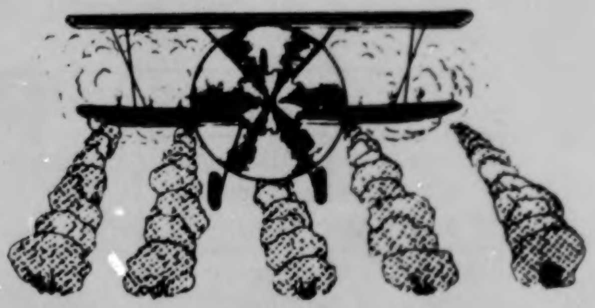
UNIT: Insect and Pest Control
(Information Sheet continued)

Insect	Adult Description	Crops Attacked
Cotton Boll Weevil	Snout Beetle, Yellowish to Almost Black	Cotton
Cotton Bollworm	(Larva Stage) Caterpillar Varies From Green to Almost Black	Cotton, Corn, Tobacco, Tomato, and Many Others
Cowpea Weevil	Reddish-Brown Beetle with two Ivory-like Robes at Base of Thorax	Cowpeas, Other Legumes
Cutworm (Several Species)	(Larva Stage) Caterpillar, Pale Brownish to Grayish White Worms	Corn, Grains, Cotton, Tobacco, Clover
Angoumois Grain Moth	Grayish Moth, 1/2 Inch Wing Spread	Cereal Grains
Granary Weevil	Chestnut-Brown Beetle, Similar to Rice Weevil 1/16 Inch Long	Cereal Grains
Grasshopper	Varies According To Species (Several)	Corn, Small Grains, Alfalfa, All Crops
Greenbug	Yellowish-Green Aphid, Tiny	Small Grains, Corn, Rice, Other Grasses
Hessian Fly	Mosquito-Like Fly, Dark Bodied	Wheat, Barley, Rye, and Some Grasses
Lygus Bug (Several Species)	Flattened, Oval Bug, Pale Green to Yellowish, Brown, 1/4 Inch Long	Alfalfa, Cotton, Beans, Sugar Beets
Mites	Four Pairs of Reddish-Orange Legs, with a Dark Body	Oats, Wheat, Barley
Pea Weevil	Grayish-Brown, 1/5 Inch Long	Peas

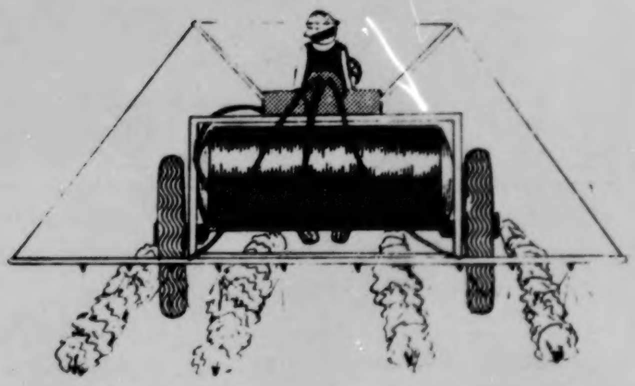
UNIT: Insect and Pest Control
(Information Sheet continued)

Insect	Adult Description	Crops Attacked
Pink Bollworm	(Larva Stage) Cylindrical, White with Pink Dorsal Side, 1/2 Inch Long	Cotton, Okra, Hollyhock, Hemp
Potato Aphid	Often Winged, Pink or Green, 1/8 Inch Long	Potato, Tomato, Several Other Plants
Potato Beetle (Colorado)	Yellow Beetle, Black Striped Wing Covers	Potato, Tomato, Eggplant, Tobacco
Rice Weevil	Black Snouted Beetle, Dull Reddish-Brown, 1/8 Inch Long	Cereal Grains
Sorghum Midge	Minute Orange-Colored Fly	Grain Sorghum
Thrips	Minute Insects with Narrow Pointed Wings Antennae 6 to 9 Segmented	Cotton and Many Other Plants
White Grub	June Bug or May Beetle, Heavy, Robust and Black in Color	Corn, All Grasses, Grains, Potatoes, and Strawberries
Wireworm	Hard-Shelled, Slender, Brown Beetle, Larva Stage Worms are Cylindrical and Yellowish-brown	Corn, Small Grains, Grasses, Potatoes, Other Root Crops
Cotton Fleahopper	Pale Green Color, 1/8 Inch, Wings are Marked with Small Dark Spots and Black Marks Near the End of Each	Cotton

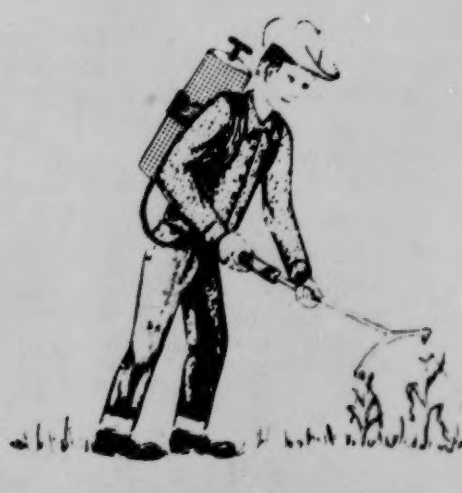
METHODS OF SPRAYING FOR INSECT CONTROL



AERIAL SPRAYING

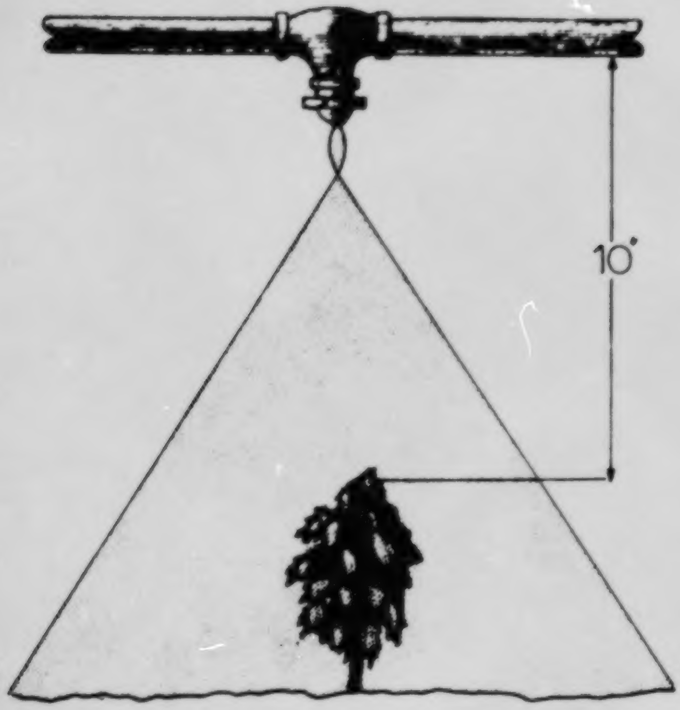


MACHINE SURFACE SPRAYING

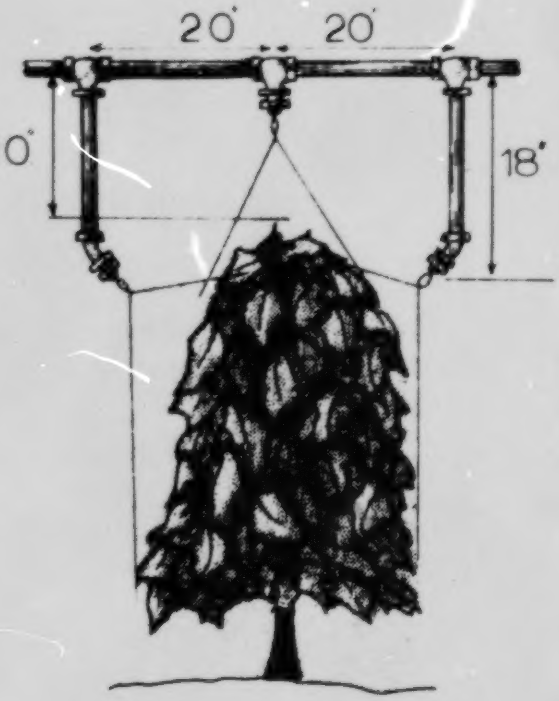


HAND SURFACE SPRAYING

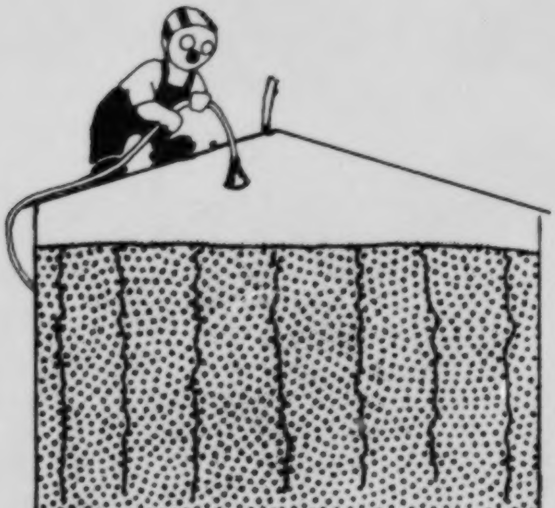
PROPER APPLICATION OF INSECTICIDE



Early-season Spraying
Use One Nozzle Per Row



Late-season
Use Three Nozzles Per Row



Controling Grain Insects with Fumigants

UNIT: Insect and Pest Control
TOPIC: Insecticides
(Information Sheet continued)

Some Insecticides Grouped by Chemical Classification

CHLORINATED HYDROCARBONS

- Endosulfan
- Lindane
- Endrin

CARBAMATES

- Sevin
- Baygon
- Temik

DINITRO COMPOUNDS

- Karathane
- Morocide
- DNC

ANIMAL PLANT DERIVATIVES

- Toxaphene
- Bacillus Thuringieniss*
- Virex B*
- Pyrethrin
- Rotenone

PHENOL DERIVATIVES

- DDT
- Methoxychlor
- Perthane

ORGANO-PHOSPHATES

- Dimecron
- Bidrin[1]
- Azodrin
- Ciodrin
- Methyl Parathion
- Systox
- Phosdrin
- Ronnel
- Guthion[1]
- Trithion[1]
- Dichlorvos
- Nalad or Dibrom[1]
- Dipterex
- Parathion
- Diazinon[1]
- Metasystox
- Linophos
- Malathion
- Di-Syston[1]
- Ethion

UNIT: Insect and Pest Control
TOPIC: Insecticides
(Information Sheet continued)

[1] Registered Chemical Trade Names
* Biological controls

This is only a partial list of insecticides. In order to know what insecticide is to be used on certain crops, check the insect control on the particular crop. Be certain to read all precautions on the label before using or handling the insecticide.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Diseases and Control

TOPIC: Definition, Classification of Diseases by Pathogens

OBJECTIVE: To develop and understand what plant diseases are and what causes them.

REFERENCES:

Required:

1. Information Sheet, "Definition and Classification of Plant Diseases".
2. "What You Should Know About Plant Diseases", Texas A&M Extension Service, B-955.

QUESTIONS OR ACTIVITIES:

1. What is a plant disease?
2. What causes plant diseases?
3. What is meant by symptoms?
4. What are fungi?
5. How do fungi reproduce?
6. Are all fungi plant pathogens?
7. What are some common examples of fungus disease?
8. What are some of the ways a fungus spore may overwinter?
9. What are bacteria?
10. How do bacteria reproduce?
11. How are bacterial diseases spread?
12. What are some common bacterial diseases?
13. What are nematodes?
14. What are some examples of damage caused by nematodes?
15. How are nematodes spread?
16. What is a virus?
17. How are viruses spread?
18. In what ways do viruses overwinter?
19. What are some symptoms of common viral diseases?

Information Sheet
on
DEFINITION AND CLASSIFICATION OF PLANT DISEASES

What is a Plant Disease?

A plant disease is a condition in which any part of a living plant is abnormal or which interferes with the normal activity of the plant's cells or organs. Diseases are caused by an agent such as bacteria are known as pathogenic diseases. A pathogen is the biological agent (fungus, bacteria, viruses, nematodes, and some anthropods) that causes disease.

Causes of Plant Diseases

FUNGUS

Fungi are tiny, thread-like microscopic plants, commonly called molds. They have no roots, stems, seeds or flowers. Instead of these organs they consist of a tubular thread-like structure.

Fungi are living plants which lack chlorophyll for manufacturing their own food and must feed on living or dead plant or animal matter. They grow at the expense of the material in which they exist.

Pathogenic fungi live and grow at the expense of the environment in which they exist. They reproduce sexually and asexually by mating of so-called plus and minus strains.

Fungi reproduce by the formation of microscopic bodies called spores, and this is done rapidly if the environmental conditions are favorable. When these spores germinate, they produce a thread-like strand which acts as an infection element.

Once the fungus infection element becomes established inside the plant, numerous strands start growing and feeding in plant tissues. Invaded tissue gradually dies as the fungus feeds on it. Fungi in decaying organic matter are called saprophytic fungi. Parasitic fungi grow on live tissue. Most common fungi grow best at high temperatures and high humidity.

Fungi may overwinter as weather-resistant spores or vegetatively in some form of decaying organic matter. Some are beneficial, in that they aid in the decaying and rotting of dead plant materials.

UNIT: Diseases and Control
TOPIC: Definition, Classification of Diseases by Pathogens
(Information Sheet continued)

Rust on wheat, seedling diseases, cotton root rot, leaf spots, and cankers are some common fungus diseases. Fungi are found in the form of mildews, molds, and mushrooms.

BACTERIA

Like fungi, bacteria are the simplest forms of plants that cannot manufacture their own food and must depend on living or dead plants for their food. Bacteria are actually one-celled plants. They are also the smallest of the many living organisms. Most of the bacteria that cause plant diseases are rod-like in shape.

Bacteria multiply by dividing. A single bacterium may produce over 47,000,000,000 descendents in a twelve-hour period. Under favorable conditions, the cells may divide once every twenty minutes.

They enter the plant through breathing pores, wounds, or they are deposited in the tissue by feeding insects. Some bacteria are actually carried inside the seed.

There are 170 known bacteria capable of causing plant diseases. Many others are helpful to man.

Symptoms of bacterial infections in plants include galls, blight, rots, retarded maturity, and bacterial wilts.

NEMATODES

Nematodes that attack plants are round, slender, thread-like worms about 1/70 of an inch long. (They are animals.) Approximately 132 species of nematodes are known to attack plants.

They are equipped with a tiny, spear-like mechanism which they insert into the plant to withdraw plant juices. They injure plant roots, thus permitting the invasion of fungi and bacteria, which enter the root system. Some feed from the outside of the roots; others feed by tunneling through the plant roots. Stem nematodes feed on leaves and stems of plants.

Root know nematodes are the most common type. Their feeding causes an abnormal enlargement of root cells in their feeding area. Foliar nematodes attack the foliage of plants.

UNIT: Diseases and Control
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(Information Sheet continued)

Plants affected by nematodes exhibit a yellowing of color or lose color entirely and lack vigor. In some instances, nematodes injure plants and cause them to be more susceptible to other diseases.

Many overwinter in the egg and larva form in the soil, in the roots of plants, and in debris.

VIRUSES

A virus is a non-living, disease-producing agent so tiny that only an electronic microscope makes them visible. They produce only in the living cell. They can be removed from the living cell and remain active. Some viruses have been photographed by magnifying them 30,000 to 50,000 times their actual size.

Even though they are non-living, they are capable of multiplying and acting like living organisms when in live tissue. The method of reproduction is by synthesis. Viruses cannot grow outside a living cell, but they may remain in dead plant tissue from one season to the next.

Virus particles may enter plants by mechanical means, insect injury, or vegetative propagation. Plant viruses can be transmitted by insects, nematodes, soil, seed, and man.

Virus diseases produce a wide range of symptoms and types of injury to plants. Some may kill the plant in a short time, while others cause lesser injuries that result in reduced yields and lower-quality products. Yellow viruses cause a yellowing of plant parts, dwarfing, curling of leaves, gall inflammation, and immaturing of plant parts. Mosaic viruses cause molting, spotting, loss of color of plant tissue, and a general mosaic appearance.

Symptoms of Plant Diseases and Definitions of Words That May Help Identify the Disease or Control Measure

Symptoms are effects produced by a disease organism on a plant.

Blasting - Causing failure to produce fruit or seed.
Blight - The rapid discoloration and death of tissue over certain portions of the plants.
Canker - A dead area on a stem surrounded by living tissues.

UNIT: Disease and Control
TOPIC: Definition, Classification of Diseases by Pathogens
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Chlorosis - Yellowing of normally-green tissues due to the partial failure of chlorophyll development. Iron deficiency often produces this symptom.
Curl - A puff-like distortion on a leaf resulting from the unequal development of its two sides.
Damping-Off - A disease of seedling plants usually caused by fungi. Early planted cotton is often affected by this disease.
Dieback - Progressive death of branches, shoots, and roots beginning at the tips. This type of condition is characteristic of unhealthy plants.
Dwarfing - The failure of any part of the plant or the entire plant to develop properly. This may be caused by nutritional deficiencies or a disease organism.
Exudate - Liquid discharges from diseased tissue.
Fumigant - A liquid or solid substance that forms vapors which destroy pathogens and insects.
Fungicide - A chemical that kills or inhibits fungi.
Gall - A localized swelling occurring on roots, stems, or branches. The stimulation for development may be caused by a diseased organism, insect, or a wound.
Host - The plant on, or in which, the parasite is living and obtaining the food.
Invasion - Growth or movement of an infectious agent into a plant, and its establishment in it.
Lesion - A localized spot of diseased tissue. Spots, blisters, and scabs are examples.
Mildew - A plant disease caused by fungal organism which forms a whitish or grayish coating over the surface of the leaves.
Mosaic - Symptom of a virus disease appearing as dark green, light green, white, or yellowish irregular spots on the leaves of affected plants.
Mottle - An irregular pattern of light and dark areas.
Mummy - A dried, shriveled fruit resulting from certain fungal diseases. Old fruit may serve as a source of infection for next year's crop.
Pustule - Small, raised, blister-like areas on the surface of leaves or other plant tissue.
Resistance - The inherited ability of a plant to retard growth of disease organisms.
Ring Spots - Yellowish rings on leaves with green tissue inside the ring. This usually is associated with virus diseases.
Rot - A state of decomposition produced by a microorganism.
Russet - Brownish, roughened areas on the surface of fruits caused by diseases, insects, or spray injury.
Scab - A crust-like, diseased lesion produced as a result of disease infection.
Scorch - Burning of tissues; the result of an infectious or non-infectious disease.

UNIT: Diseases and Control
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(Information Sheet continued)

Wilt - Loss of freshness and drooping of plants caused by an inadequate water supply or excessive transpiration or by a vascular disease which interferes with utilization of water by a plant.

Witches Broom - A disease symptom in which there is an abnormal brush-like development of many weak shoots.

When to Suspect Plant Disease

When all or part of a plant dies
When roots, stems, leaves, or other plant parts grow abnormally
When the use of plant food nutrients, watering, and control of weeds and grass or insects fail to give expected yields
When a certain kind of plant or seed gradually yields less or "runs out" over several years

What May Help in the Identification

Eliminate the possibility of causes other than diseases

- Insect damage
- Injury caused by dogs, cats, rats, other animals, or children
- Damage by too cold or too warm weather
- Too little or too much moisture
- Too acid or too alkaline a soil
- Blowing sand on drying winds
- Growing on poorly drained soils
- Too much fill soil used

Are plants native to the area?

Have plants received different treatment (fertilizing, pruning, etc.)

If impossible to identify the disease, the plant may be sent to one of the following addresses (fill out form D-418)

Plant Disease Diagnostic Lab
Texas A&M University
College Station, Texas 77843

UNIT: Diseases and Control
TOPIC: Definition, Classification of Diseases by Pathogens
(Information Sheet continued)

For areas south of San Antonio:
Area Plant Pathologist
Box 476
Weslaco, Texas 89596

The soil nematodes live in a small soil area; they may not move more than thirty inches in a year. They are usually spread by water movement (irrigation), transfer of infested plants, soil on machinery, hoofs of animals, and shoes of workers. The bud, leaf, and stem nematode may hatch and live in the plant but may get into the soil and live from one season to the next.

Nematodes live in moist soil, in plant tissue and other organisms, as well as in decaying matter. The predacious species live on small animal life and other organisms. The saprophagous species live on decaying plant matter and a third species, cyst nematode, feed on plants.

There are several genera of soil nematodes. The most common types are as follows:

Root-knot, genus Meloidogne
Cyst, genus Heterodera
Burrowing, genus Radopholus
Lesion, genus Pratylenchus
Sting and owl, genera Belovolaimus and Dolichodorus
Citrus, genera Nacobbus and Meloidodera
Bud and leaf, genus Aphelenchoides
Stem, genus Ditylenchus
Seed-gull, genus Anguina
Stubby-root, dagger, and needle, genera Xiphinema and Longidorus
Lance, genus Hoplolaimus

Nematodes are known as thread worms, roundworms, and eelworms. They are generally thought of as plant and animal parasites, but some writers class certain nematodes (root surface feeders) as grazers and browsers.

Since nematodes are resistant to most chemicals, it has been necessary to develop fumigants from volatile and other similar chemicals. There are many treatments effective against nematodes, but none has a permanent, lasting effect against this particular soil parasite.

UNIT: Diseases and Control
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The practices that have been approved in controlling the nematode are as follows:

Sanitation - Soils have been cleaned of materials that provide a natural habitat. Sterilization by steam and heat have proven to be successful in cleaning soils.

Crop rotation - Plants that do not serve as a host to the nematode have been planted in infested soils.

Fumigation - Chemical control methods have been used with success since 1945. The cost may vary from $40 to $500 per acre.

Flooding - Areas remaining under water for periods of time have been freed of nematodes.

Selection of Planting Stock - Planting stock should be inspected for nematode symptoms before it is transferred to a soil free of nematodes.

Fallowing - Land is allowed to be idle for a growing season. The land is usually cultivated to destroy weed growth and conserve timber.

Types of Nematodes

CYST FORMERS

Cabbage Cyst Nematode, Heterodera cruciferae	Cabbage
Carrot Cyst Nematode, H. carotae	Carrots
Clover Cyst Nematode, H. trigolii	Clover and other legumes
Golden Nematode, H. rostochiensis	Irish potato, Tomato, Eggplant
Grass Cyst Nematode, H. punctata	Small grains, like wheat
Hop Cyst Nematode, H. humuli	Hop, Hemp
Oat Cyst Nematode, H. avenae	Small grains, Corn, Grass
Pea Cyst Nematode, H. goettingiana	Peas
Soybean Cyst Nematode, H. glycines	Soybeans
Sugar Beet Nematode, H. schachtii	Celery, Sugar Beets, Cress, Turnips, Spinach, Radishes
Tobacco Cyst Nematode, H. tabacum	Tobacco, Tomato

UNIT: Diseases and Control
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(Information Sheet continued)

ROOT PENETRATING NEMATODES (ENDOPARASITIC)

Potato Rot Nematode, Ditylenchus destructor	Potato, Dandelion

ROOT-KNOT NEMATODES, MELOIDOGYNE SPP.

(Several species and varieties)	Found in more than 1,700 host plants including small grains, grasses, fruits, vegetables, nursery crops and field crops.

ROOT LESION OR MEADOW NEMATODES

Smooth-headed nematode. Pratylenchus brachyurus	Potato, Corn, Peanuts, Cotton, Tobacco,
Coffee Nematode, P. coffeae	Coffee, Tea, Abaca, Cane, Banana, Tobacco, Wheat Corn, Olive, Apple, Nursery and Floral Crops
Schribner's Meadow Nematode, P. scribneri	Potato, Strawberry
Thorne's Meadow Nematode, P. thornei	Wheat Grains, Grass
Lesion Nematode, Pratylenchus sp.	Fruits, Citrus, Walnut Grape, Raspberry, Rose
Corn Nematode, P. Zeae	Corn, Wheat
Rice Nematode, Aphelenchoides oryzae	Rice
Burrowing Nematodes, Radopholus similis	Citrus, Ornamentals, Avocado
Kidney-shaped or Reniform Nematode, Rotylenchulus reniformis	Turf, Cotton, Peanut, Tomato, Ornamentals
Citrus Nematode, Tylenchulus semi-penetrans	Citrus trees, Olive

NEMATODES THAT FEED ON ROOT SURFACES (ECTOPARASITIC)

Sting Nematode, Belonolaimus spp.	Corn, Cotton, Ornamentals, Celery, Vegetables, Peanut, Pine
Ring Nematode, Criconemoides spp. and Criconema spp.	Cotton, Peanut, Citrus, Deciduous Fruit

UNIT: Diseases and Control
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True Spiral Nematode, Helicotylenchus sppp.	Peanut, Tobacco, Tomato, Clover
Lance Nematode, Hoplolaimus spp.	Nursery Crops, Cane, Alfalfa, Red Clover, Peppermint
Pin Nematodes, Paratylenchus spp.	Many Vegetable Crops
Spiral Nematodes, Rotylenchus spp.	Ornamentals
Stubby Root Nematodes, Trichodorus spp.	Corn, Celery, Beans, Peas, Tomato, Cotton, Beets, Pepper
Stylet Nematode, Tylenchorhynchus sp.	Milo, Peanut, Beans, Ornamentals
Dagger Nematode, Xiphinema sp.	Cotton, Strawberry, Oats, Tobacco, Peaches, Nursery Stock

General Characters of Bacteria

Man has known for several years that fungus diseases cause tremendous economic losses to crops, but not until more recent years has he recognized that bacteria diseases also cause losses.

Bacteria, being some of the smallest organisms known to man, require the microscope to be seen. They are significant in our society because they are small and multiply rapidly and are involved in various biochemical activities.

Bacteria cells multiply by dividing (fission) into two cells. Division of each cell may occur every hour so that if all of the descendents of one cell lived, in 24 hours there would be about 17,000,000 individual cells. It is easy to see that when we provide the right conditions for bacteria to grow and reproduce, their influence or damage can appear "overnight".

The three general shapes of bacteria are spherical (cocci), cylindrical (called rods or bacilli), and spiral, with loops or just a small section of a spiral (vibrio). Their ends may be pointed or blunt. Some form spores, some are motile, and some are capable of both.

UNIT: Diseases and Control
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Bacteria, like plants, obtain nutrients for growth and reproduction by absorbing food materials in solutions through their cell walls. Some forms are able to manufacture all of their food requirements, while others must have these factors supplied in various forms.

Although all bacteria require a definite, but small, concentration of carbon dioxide (CO_2) to grow, they can be divided into four groups in regard to their need for oxygen from the air. These include:

Facultative anaerobes - Can grow and reproduce in either the presence or absence of air.
Obligate anaerobes - Remain dormant or die in the presence of air.
Microaerophylic - Can tolerate only a small amount of oxygen.
Obligate aerobes - Must have a full supply of air in order to grow.

The terms aerobic and anaerobic are easily remembered if the student will realize that the first three letters of aerobic could be spelled air, which would mean air is present. The prefix an in anaerobic comes from the word anti, which means against or opposite. The opposite of air being present is air being absent, so anaerobic means in the absence of air.

Bacteria produce an interesting effect when present in the bloodstream of an animal (man included). The student is probably familiar with the general theory behind vaccinating animals, so we will attempt to support this theory with a general example.

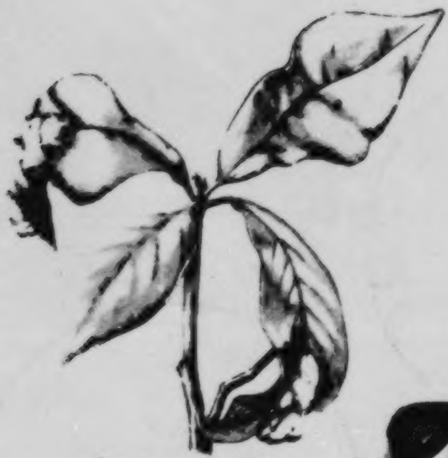
> Blackleg in cattle is caused by an infection of certain species of bacteria. We inject a certain amount of dead bacteria of these species into the bloodstream of a healthy calf. These bacteria cause substances, known as antibodies, to form in the animal's bloodstream. Since these bacteria were dead, they cannot reproduce; but, the calf now has these antibodies in his body ready to devour any bacteria of this type. So, if the calf gets into an infected area and some of these bacteria invade his bloodstream, the antibodies present eat them and they never get the chance to reproduce and build up. Thus, we say that the calf is vaccinated against Blackleg.

Plant diseases cannot be controlled by methods similar to those used on animals (vaccinations and injections). Plant diseases must be controlled by using cultural practices such as developing resistant varieties, using direct contact chemicals and by using approved soil disease control practices.

UNIT: Diseases and Control
TOPIC: Definition, Classification of Diseases by Pathogens
(Information Sheet continued)

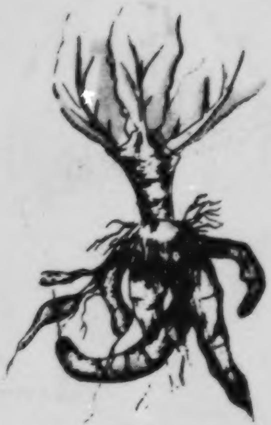
Just as we have learned to identify diseases of animals in the field, so must we do for plant diseases. If the student plans to become a pathologist, he will learn to identify different fungi, viruses and bacteria. For our purpose in this course of study, the student should learn to identify plant and animal diseases based upon symptoms and experiences (both his and those of others), and use the chemicals available for controlling them.

HYPERPLASTIC FUNGAL DISEASE



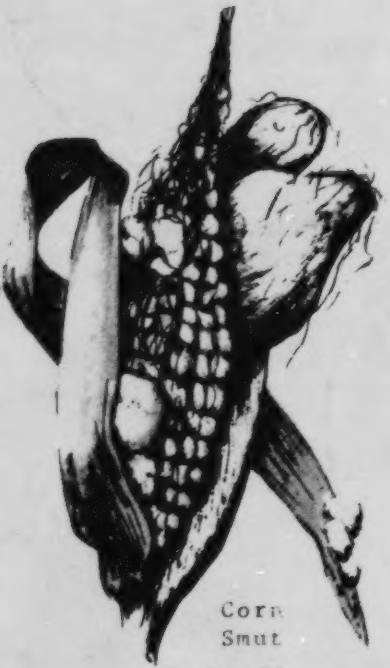
Peach leaf Curl

Taphrina deformans



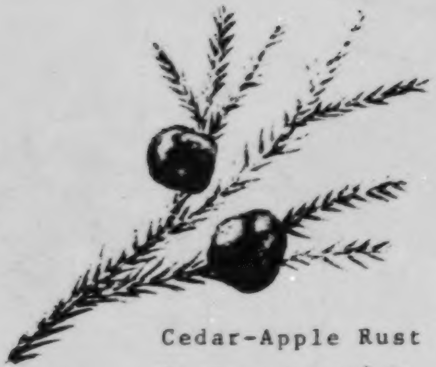
Clubroot of Crucifers

Plasmodiophora brassicae



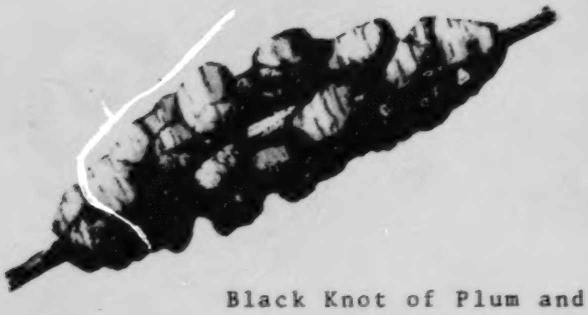
Corn Smut

Ustilago maydis



Cedar-Apple Rust

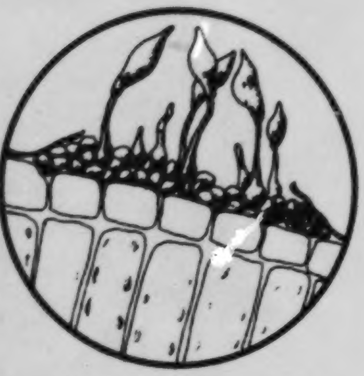
Gymnosporangium juniperi-virginianae



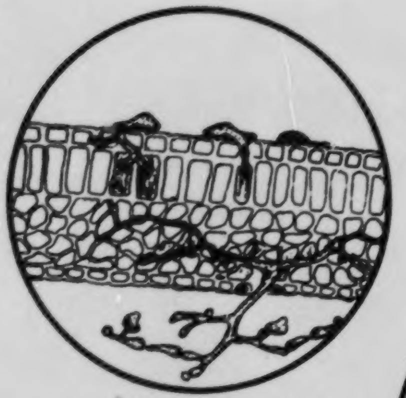
Black Knot of Plum and Cherry

Dibotryon morbosum

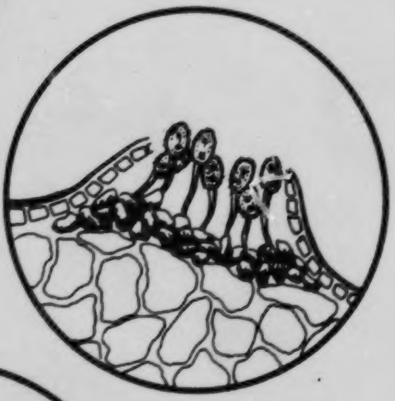
Necrotic Fungal Fruiting Structures



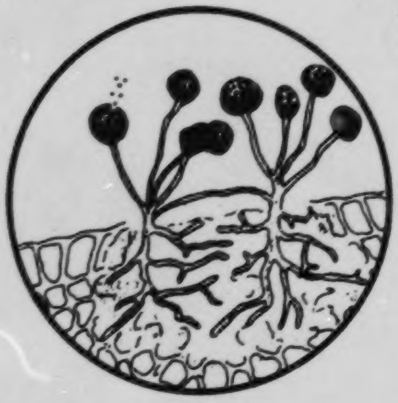
CONIDIA



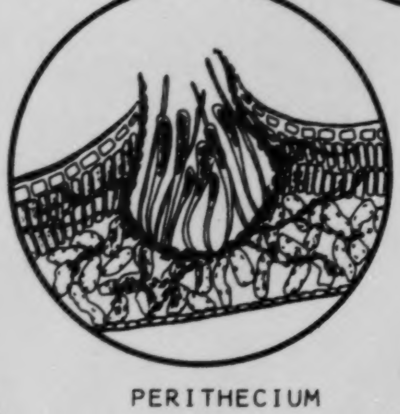
ZOOSPORES &
ZOOSPORANGIUM



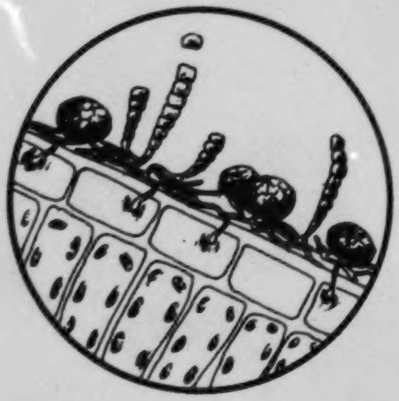
UREDIUM



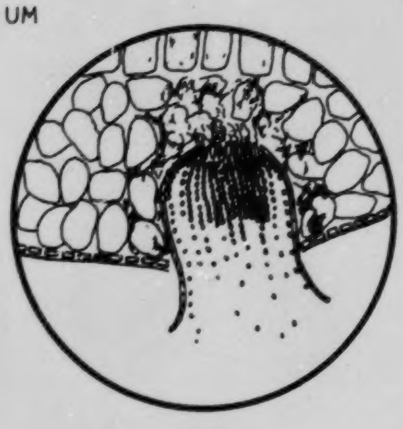
SPORANGIA



PERITHECIUM

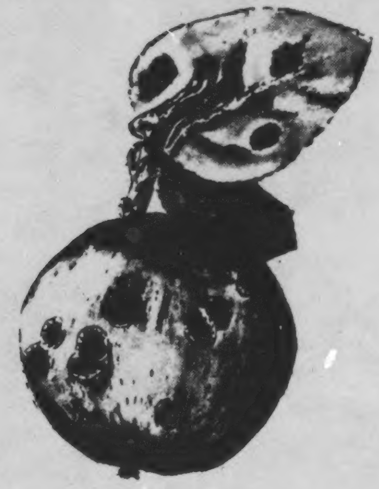


CLEISTOTHECIA &
CONIDIA



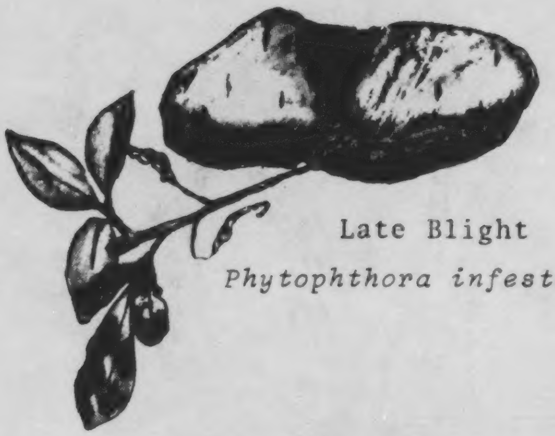
AECIUM

Necrotic Fungal Diseases



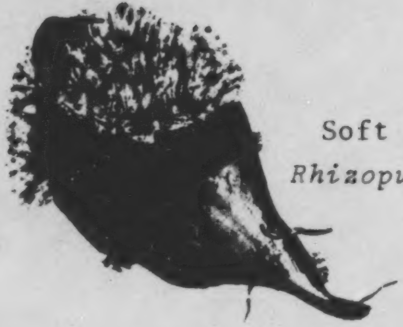
Apple Scab

Venturia inequalis



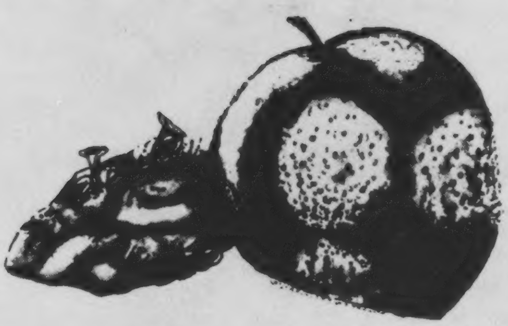
Late Blight

Phytophthora infestans



Soft Rot

Rhizopus sp.

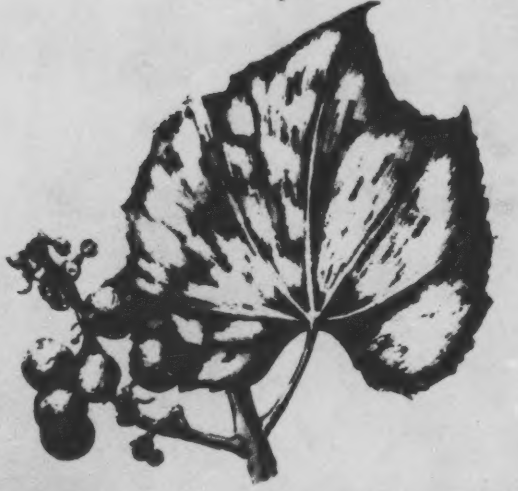


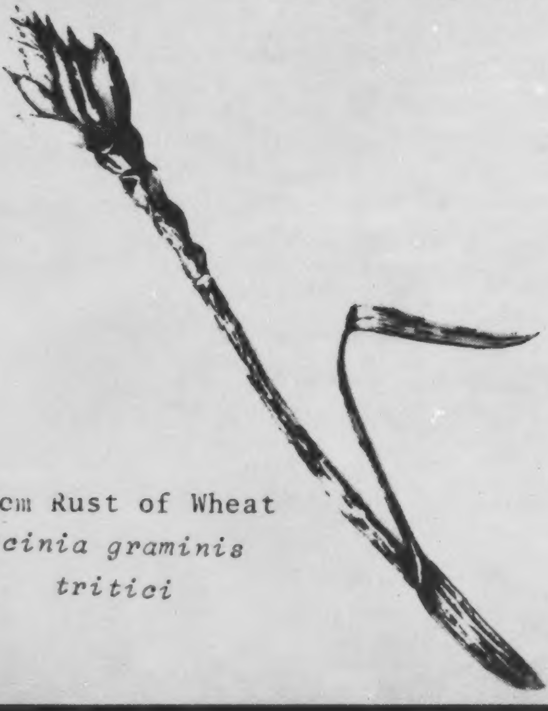
Brown Rot of Stone Fruits

Sclerotinia fruticola

Downy Mildew of Grape

Plasmopora viticola

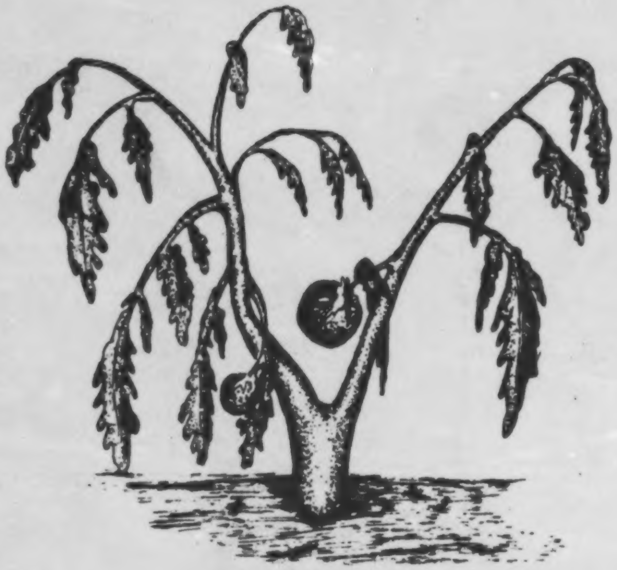




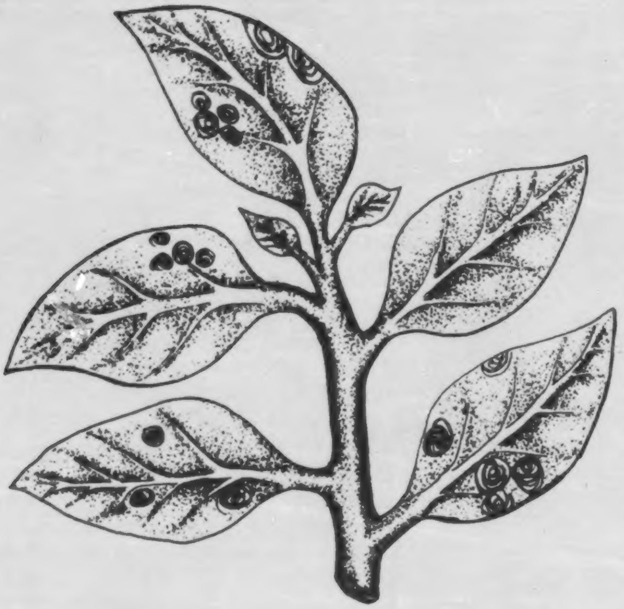
Stem Rust of Wheat

Puccinia graminis tritici

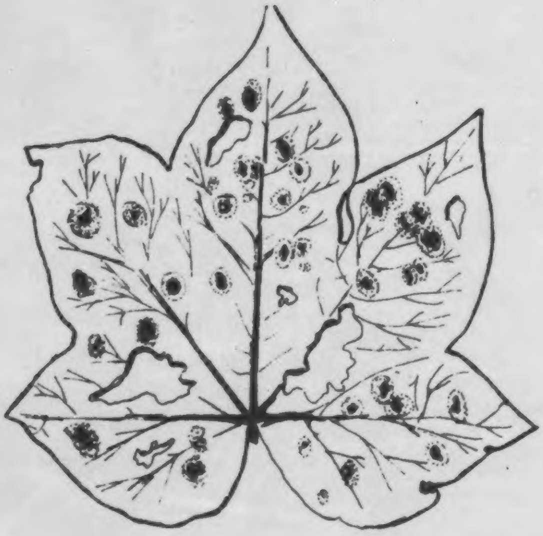
FUNGI



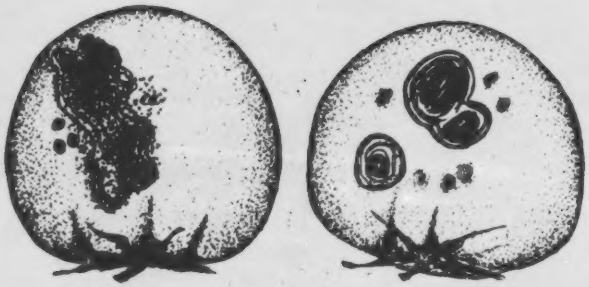
WILT CAUSED BY FUNGI ENTERING ROOT AND STEM



LEAF SPOT OR EARLY BLIGHT

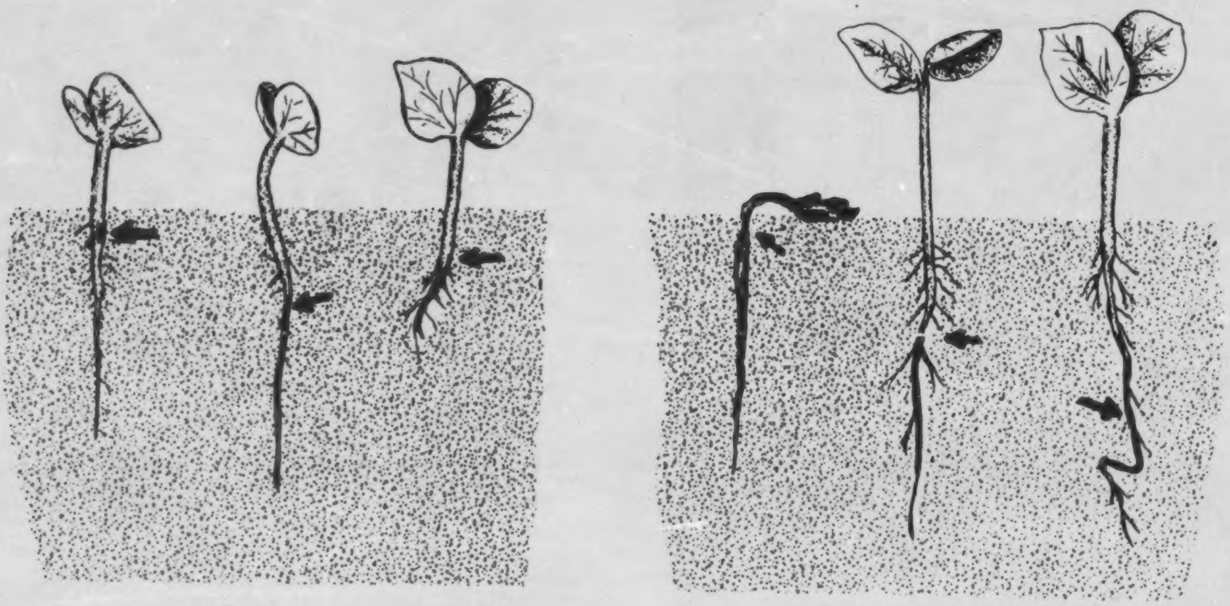


RUST ON COTTON

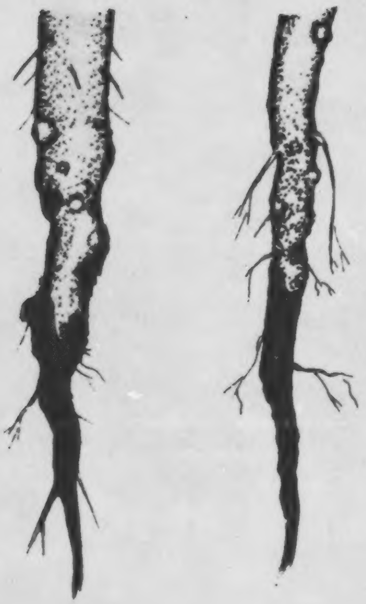


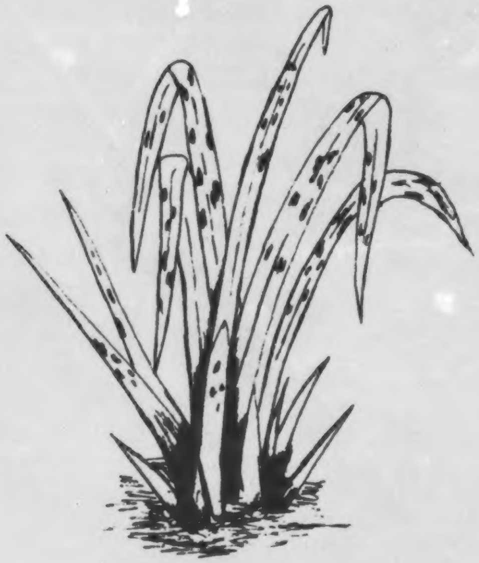
SOIL ROT IN WET SOIL

FUNGI



YOUNG PLANT ROOTS DESTROYED BY FUNGI

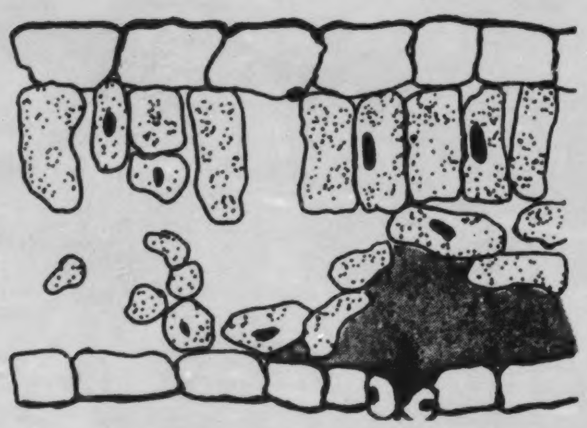




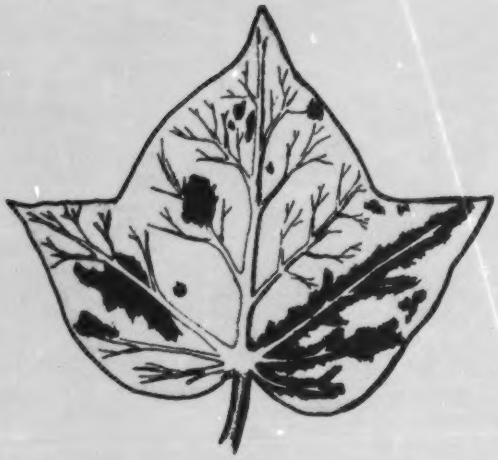
RUST FUNGUS ON GRASS

COTTON ROOT ROT

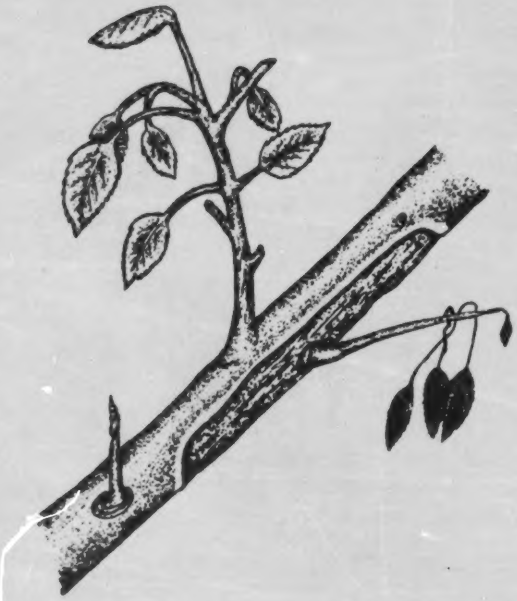
BACTERIAL DISEASES



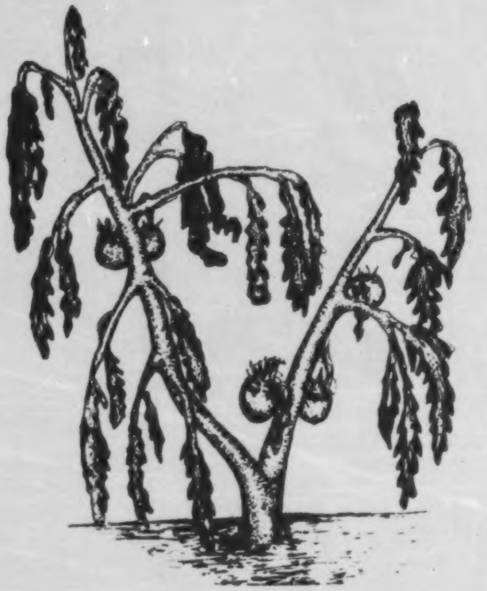
BACTERIA ENTERING THROUGH A STOMATA



ANGULAR LEAF SPOT OR BACTERIAL BLIGHT ON COTTON

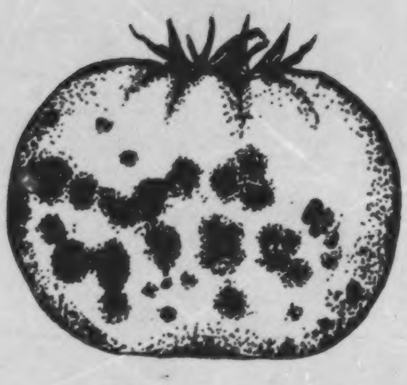


BACTERIAL CANKER DISEASE OF FRUIT TREES

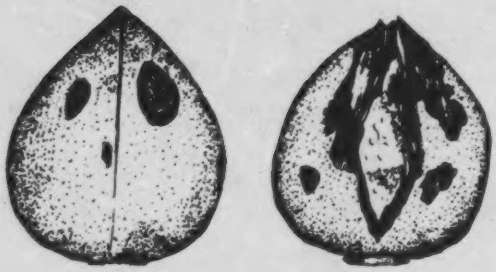


BACTERIAL WILT OF TOMATO PLANT

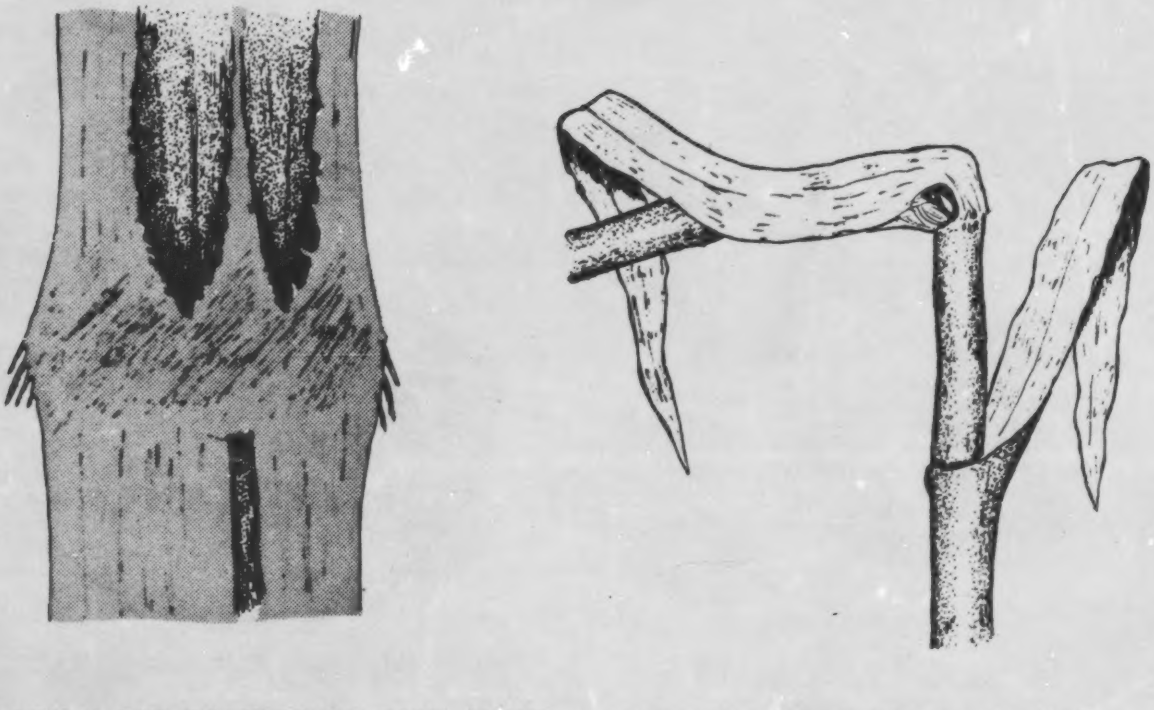
BACTERIAL DISEASES



BACTERIAL SPOT ON TOMATO

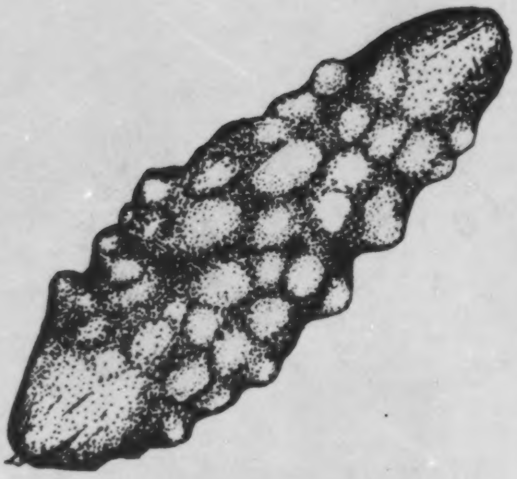


BACTERIAL BLIGHT ON COTTON

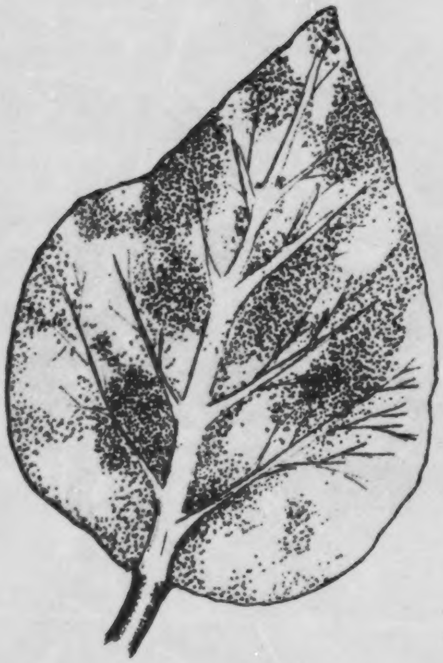


STALK ROT DISEASE ON CORN PLANT - INTERNAL AND EXTERNAL DAMAGE

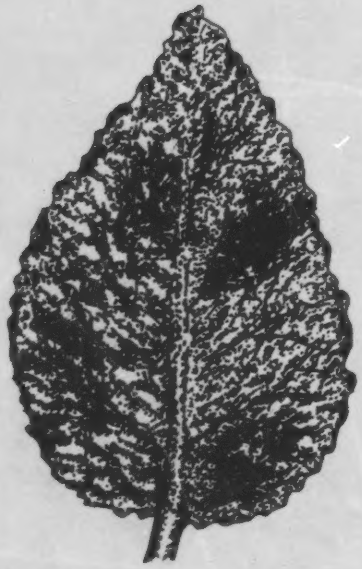
VIRUSES



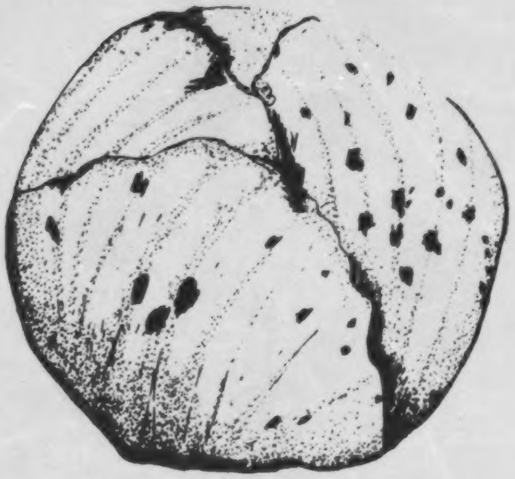
CUCUMBER WITH DARK MOSAIC



DARK GREEN MOTTLING DUE TO MOSAIC VIRUS

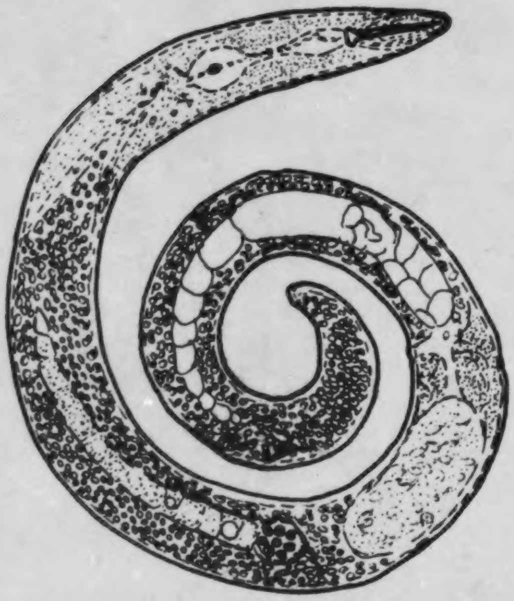


LEAF WRINKLED DUE TO VIRUS

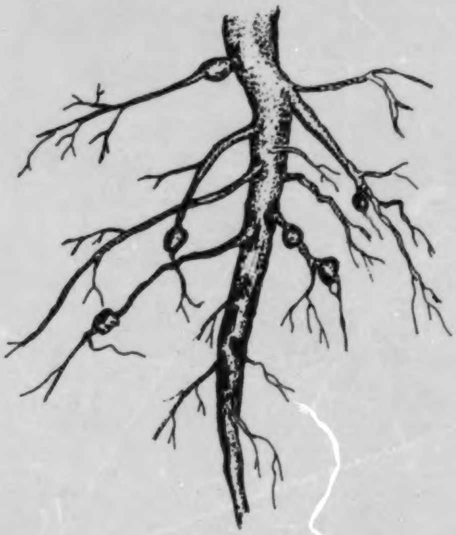


MOSAIC VIRUS ON CABBAGE

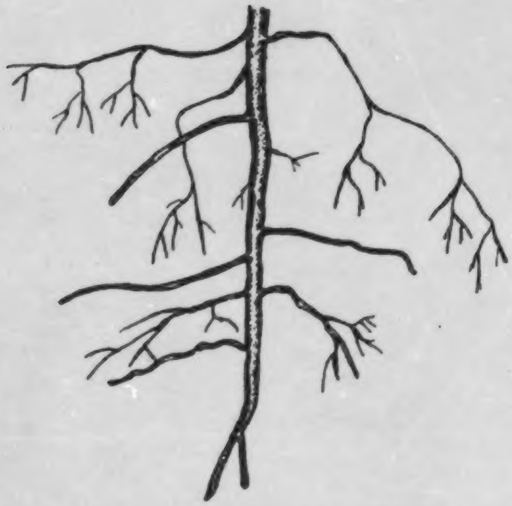
NEMATODES



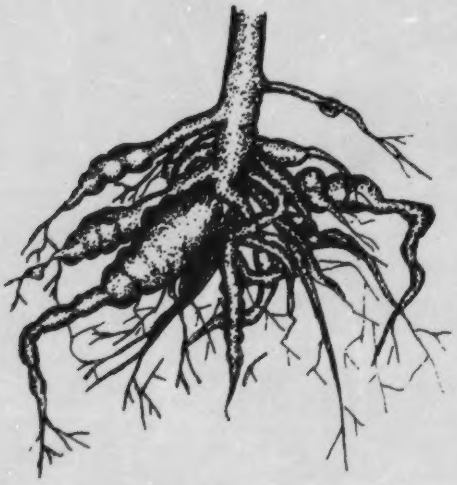
NEMATODE - SIZE LESS THAN 2.0 MM



GALLS OR KNOTS ON ROOTS



STUBBY ROOT OR RENIFORM ROOT



ROOT KNOT DISEASE

D-418 (Revised)

PLANT DISEASE DIAGNOSTIC LABORATORY

Obtain a copy of MP-512, Identifying Plant Diseases, from your county Extension agent before collecting, packing and shipping a plant disease specimen. ***Please read and follow instructions in the publication on how to identify a plant disease and how to collect, package and ship sick plants.***

Fill out the following Plant Disease Specimen Record as completely as possible. Mail a copy of this sheet with the plant disease specimen. Address the package to Plant Disease Diagnostic Laboratory, Texas Agricultural Extension Service, College Station, Texas. Persons living near Lubbock or Weslaco may send their specimens to the area Extension plant pathologist at one of these Research and Extension centers.

Plant Disease Specimen Record

Date ____________ Grower ______________________________

Box and R.F.D. ____________ City ____________ County ____________

Crop or plant ____________ Variety ____________ Acreage ____________

Plants affected (%) ____________ Yield loss (%) ____________ Soil type ____________

Occurrence (underline appropriate phrase):

Occasional   Scattered   Small areas   Large areas   Whole fields

Other crops or plants grown on area during last 5 years: 19____________,

19____________, 19____________, 19____________, 19____________

Age of shade tree or shrub: ____________ years. Soil pH: ____________

Describe symptoms of disease specimen at time of collecting. (See list of words that describe plant diseases in MP-512.)

____

____

____

When did plants first get sick? ______________________________

Fertilizer program ______________________________

____

Disease and insect control practices ______________________________

____

Weed killer practices ______________________________

Source of seed or transplants ______________________________

(over)

Date of planting____________________ **Date of last rain**____________________

Irrigation program____

Neighboring crops____

Insect situation now and during last month________________________

Other information that might help in diagnosis____________________

Sent in by______________________________ **Date**__________

Address______________________________ **Occupation**__________

Do not fill in below

Diagnosis____

Cause____

Treatment____

Reply by______________________________ **Date**__________

Title____

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15M—11-65, Reprint

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Diseases and Control

TOPIC: Principles of Plant Disease Control

OBJECTIVE: To lead the student in understanding the principles of controlling plant diseases.

REFERENCES:

Required:

1. Information Sheet for "Principles of Plant Disease Control".
2. "What You Should Know About Plant Diseases", Texas Agricultural Extension Service, B-955.

QUESTIONS OR ACTIVITIES:

1. What is necessary for a disease condition to exist in a field crop?
2. What is meant by manipulation of the environment?
3. Why is a thorough knowledge of a disease cycle necessary for preventing a disease?
4. Why is it necessary to prevent a disease condition in a crop?
5. Why is it important to eradicate weeds around a field as well as in the field?

Information Sheet
for
PRINCIPLES OF PLANT DISEASE CONTROL

Plant disease control is probably the most misunderstood area of agricultural production because the word "control" is not the right term. Weeds and insects can be controlled in a field, but once a plant becomes infected, the disease cannot be controlled.

Plant diseases cannot be controlled, so protection is most effective when it prevents the plants from being infected by an organism. To get a clearer understanding of this, several terms and definitions must be explained. No disease is a disease in itself. So for a plant disease to occur, three things are necessary: a casual organism, a susceptible host, and the correct environment. If any of these three are not present, a plant disease cannot grow. Elimination of any of these will help prevent the disease. Therefore, control is best considered as prevention by manipulation of the host, environment, and disease producing organism.

Prevention of Plant Disease

Many methods have been tried to prevent plant disease, but the best method is one directed toward the host. In other words, efforts are made to develop plants not susceptible to a disease-producing organism.

Prevention directed toward the host

Many situations have occurred in the past that have pointed out the necessity of continually breeding plants that are not susceptible to plant diseases. Regardless of what plant is cultivated and where it is grown, sooner or later the plant will become susceptible to a disease. This is a fairly broad statement but it has held true over many years. The cheapest and best method of preventing a plant disease is to plant a variety of crop that is resistant to diseases prevalent in any locality. This may not be possible, however, and if there are no varieties resistant to a particular disease then other steps will have to be taken.

Prevention directed toward the environment

The next best method of preventing a disease is to control the environment necessary for the disease to spread. This involves many things and may include deep plowing to turn trash and weeds under so they will decompose, rotations with non-susceptible crops, and removal or destruction of weeds around a field. There are other management practices that may be employed, but these are the main ones and they illustrate what is meant by controlling the environment.

UNIT: Diseases and Control
TOPIC: Principles of Plant Disease Control
(Information Sheet continued)

If a fungus spore overwinters in plant residue, the material can be turned under and it will decompose, thus removing the overwintering area of the spore. If a disease has a secondary host, which is usually a weed, and if the host weed is destroyed, then the pathogen will be eliminated at that point. If nonsusceptible crops are planted, the pathogen will have no host upon which to complete its life cycle and the disease will be prevented at some time in the future by managing weeds in and around a field. By using proper residue management, a farmer may again plant his main crop.

Prevention directed at the pathogen

If, as a last resort, a farmer has to depend on a spray program, it must be started before the disease condition shows up in a field. This is normally referred to as a preventive spray program based on forecasts. If a farmer is sure of his disease problems, he can begin a spray program before the weather conditions become ideal for the start of the disease cycle. By continuing the spraying every 7 to 10 days, the occurrence of the disease will be greatly reduced or even eliminated.

The main thing to remember is that once a disease condition develops in a crop, nothing can be done to eradicate the disease from infected plants.

Nematodes

Nematodes are a plant pathogen or they may be beneficial. If losses due to nematodes are realized one year, then steps can be taken to prevent nematode damage in the future. The methods of applying fumigants may vary but methods of controlling nematodes are similar to controls for fungi and bacteria.

Viruses

Viruses are another group of plant pathogens and if a farmer has a virus disease in a crop, there is very little he can do. In order to avoid a virus condition, a farmer should buy disease-free seed, clean and sanitize all equipment, practice good land management, or go to another crop or variety that is not susceptible to the virus.

Points to remember

1. Before any plant disease can be controlled, the life cycle of the disease must be understood.
2. The most economical method of preventing a disease is to plant resistant crops.

UNIT: Diseases and Control
TOPIC: Principles of Plant Disease Control
(Information Sheet continued)

3. The only way to prevent a pathogen from reaching damaging levels is by spraying. This should only be done after one has:
   (a) a thorough knowledge of the life cycle and (b) has tried to eliminate pathogens by management and by planting resistant varieties.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Diseases and Control

TOPIC: Chemical Control

OBJECTIVE: To lead the student to a knowledge of how plant diseases can be controlled by chemicals.

REFERENCES:

Required:

1. *Plant Science*, Janick and others, pp. 353-359.
2. Information Sheet, "Diseases and Their Chemical Control".
3. "What You Should Know About Plant Diseases", Texas Agricultural Extension Service, B-995.

QUESTIONS OR ACTIVITIES:

1. Why control plant diseases?
2. What has been one of man's most persistent problems?
3. How many of our people are well fed?
4. What are pathogens?
5. When does the incubation stage begin in the disease cycle?
6. What is the meaning of inoculation?
7. When does the incubation stage or phase end?
8. When is the best time to control diseases?
9. What are viruses?
10. Give the symptoms of yellow and mosaic viruses.
11. Define bacteria.
12. Why is it important to be familiar with fungi that cause plant diseases?
13. What is a nematode?

Information Sheet
on
DISEASES AND THEIR CHEMICAL CONTROL

Fungicides have been used for a long time, with the first recorded use being in 1821. Since that time, improvements have been made in the uses and numbers of fungicides. Today, fungicides are classified according to their use; and it is necessary that the student become familiar with this classification.

The classification of fungicides according to their use is as follows:

Seed Protectants

Fungicides used as seed protectants are applied as dusts or "slurries" to prevent blight, damping off, and root rot. Chemicals that may be used are Spergon, Orthocide 75, Panogen, Arasan, and Ceresan "M".

Foliage and Blossom Protectants

Chemicals applied as dusts or sprays to prevent blossom blight and leaf spot diseases. Some recommended chemicals are Captan, Ferbam, Karathane, and Maride "M".

Fruit Protectants

Chemicals in this group would be applied to prevent harvest rots and blemishes. Dithant M 22, Thylate, Manzate, and Captan may be used as fruit protectants.

Eradicants

There are only a few fungicides that can eradicate a disease once it is present. Chemicals that may be used to eradicate diseases are Phix, Tag, Panogen, Puratized, and liquid lime-sulfur.

Antibiotics

This chemical is recognized as being related to penicillin and other so-called "wonder drugs". Antiobiotics are recommended for the control of fire blight. Recommended chemicals to control blight are Phytomycin, Agrimycin, and Acti-Spray and Agri-Strep.

Soil Fumigants

These are used to eradicate soil borne disease fungi in gardens, greenhouses, and plant beds. These chemicals are used in the form of gas or water soluble materials and are Methyl bromide, MC, Picfume, Vapam, VPM, and Bedrench.

General Purpose Sprays and Dust Formulations

These are chemicals applied as sprays and dusts and commercial products that contain the proper mixtures for the control of fungus around the home.

UNIT: Diseases and Control
TOPIC: Chemical Control
(Information Sheet continued)

Fungicides are used in several forms, with some of these being: wettable powders, dusts, emulsifiable concentrates, granules, solutions, and suspensions.

Familiarize yourself with the above terms; a definition of each can be found in Agricultural Chemicals, Book I by W. T. Thomson.

In many instances, fungicides have been declared a failure when in reality the ineffectiveness was due to the ignorance of the user. In order for fungicides to protect plants from disease, they must be applied at the proper time, at the recommended rate, and the mixture must cover the entire foliage or fruit of the plant.

Most of the fungicides in use today are classified as protectants; that is, they protect the plant from the fungus rather than kill the fungus. If the fungicide was applied at the rate required to kill the fungus, it would injure the plant.

There are more than 250 trade names of fungicides suggested for the control of fungi. This is too many for the average person to remember. Also, the individual may become confused by two names being used, the trade and common name. Because chemical companies sell fungicides with the same ingredients under different names, and because the trade name and common name of fungicides are both used, the following chart is given to assist the student in identifying fungicides.

Common Name	Chemical	Manufactor's Trade Name
Captan	N-trichloromethylthiotetrahydrophthalinide	Orthocide 50 Wettable, Orthocide 75 Seed Protectant, etc.
Chloranil	Tetrachloroparabenzoquinone	Spergon, Spergon-SL, Spergon Wettable, etc.
Dichlone	2,3 dichloro, 1, 4-naphthoquinone	Corona Phygon-XL, Phygon XL, Phygon Navgets, etc.
Dodine	Dodecylquanidine acetate	Cyprex
Ferbam	Ferric Dimethyl dithiocarbamate	Fermate, Ferberk, Karbam Black, Ferradow, etc.
Glyodin	2-Heptadecyl glyoxalidine	Crag 341-C, Crag Glyodin solution
Maneb	Ethylene Bisdithiocarbamate	Manzate, Dithane-M 22
Nabam	Disodium Ethylene Bisdithiocarbamate	Dithane D-14, Parzate liquid, etc.
Thiram	Tetramethyl Thiuram Disulfide	Arasan, Panoram, Thylate, etc.

UNIT: Diseases and Control
TOPIC: Chemical Control
(Information Sheet continued)

Zineb	Ethylene Bisdithiocarbamate	DuPont Fungicide "A", etc.
Ziram	Zinc Dimethyl Dithiocarbamate	Corozate, Karbam White, Niagara Z-C, etc.

Assuming a positive identification of the fungus or disease has been made, several important decisions must be considered before applying the fungicide. These are: selection of the fungicide to use, kind of auxiliary agent to use-if any- kind of application, method of application, and time of application.

In order to make a wise choice of fungicides, the student must possess knowledge of the compatibility of the fungicide to other fungicides and chemicals, the susceptibility - high, low, or medium - of the fungus to the fungicide, point of infection, and the habitat - growth stages and soil conditions of the fungus.

Several auxiliary agents which usually increase the effectiveness of the fungicide are available. These agents and an explanation of each are as follows:

Wetting Agent - A material used with the fungicide to reduce the surface tension of particles and to eliminate air between a solid and a liquid.

Spreader - A material used to facilitate creeping or spreading over a surface so that the area covered is increasingly greater.

Adhesives - Material used to increase the adhesion of fungicides.

Deflocculating Agents - Materials which keep particles from each other to prevent flocculation and to assure dispersion and to retard settling of a solid within a liquid.

Emulsifier - A material used to facilitate formation or increase dispersion of one liquid within another.

Safeners - A material used to counteract the chemical characteristics of a material which may normally cause phytotoxic effects.

The kinds of applications available are complete sprays, mist sprays, dusts, aerosol fog, and fumigants. In controlling fungus, one must decide the kind of fungicide application to use.

UNIT: Diseases and Control
TOPIC: Chemical Control
(Information Sheet continued)

As was stated in a previous paragraph, the method of applying the fungicide is important. Methods that may be used are seed treatment, spraying, dusting, drenching, furrow treatment, planter treatment, soil fumigation, dips, and paints.

Possibly, one of the most important decisions in controlling fungus is to determine the time to apply the fungicide. To make this decision, one must understand the stages of fungus growth, the conditions of plants, moisture conditions, temperature, humidity, and equipment available.

The halogenated hydrocarbons are considered the most effective nematocides since nematodes are sensitive to the halogens. As mentioned in the topic, "Nematocide Uses and Terminology", there are five compounds that are considered most effective against the nematode. The compounds are:

1. Methyl bromide
2. Ethylene bromide
3. Dichloropropene
4. Chloropicrin
5. Dibromochloropropane

Each of the compounds has certain characteristics which distinguish them from other compounds used for the same purpose.

The five most common types of nematocides used to control nematodes are:

> Dichloropropene known as 1, 3-dichloropropene and 1, 2-dichloropropane is a brown volatile liquid soil fumigate. The soil fumigant made up of 1, 3-dichloropropene and related C_3 hydrocarbons is sold under the trade name TELONE.
>
> Ethylene dibromide is a clear liquid fumigate. Formulations containing a certain percent of the chemical are sold under the trade names of DOWFUME W-85, SOILFUME 85, BROMOFUME 85, and NEMEX 85.
>
> Nemagon soil fumigate is a chemical compound 1, 2-dibromo-3-Chloropropane. It is a heavy, straw-colored liquid. The compound formulation is also sold under the trade name FUMAZONE.
>
> Methyl bromide is one of the better known soil fumigants; it is a gas. When 1.4 percent of chloropicrin and 68.6 percent methyl bromide are mixed as a soil fumigant, it is sold as BROZONE. Different percentage mixtures of the same two fumigants are sold as DOWFUME MC-2 and MC-3, and TRIZONE.

UNIT: Diseases and Control
TOPIC: Chemical Control
(Information Sheet continued)

Chloropicrin is a yellowish volatile liquid sold under the trade name PICFUME and LARVACIDE. It is known as tear gas.

Fumigant trade names and their compound formulations are:

DD, Vidden D (dichloropropene - dichloropropane)
Telone (dichloropropene)
Dowfume - W-85 Soilfume-85 (ethylene bromide, called EDB)
Trizone (methyl bromide + chloropicrin + propargyl bromide)
Bromethane, Bromogas, Dowfume MC-3 (methyl bromide)
Fumazone, Nemagon (dibromochloropropane)
Dorlone, Fieldfume (dichloropropene + ethylene dibromide)
Vapam (sodium methyl dithocarbamate)
Vorlex - (methyl isotheocyanate + dichloropropene + dichloropropane)

No nematocide is ideal for all purposes. Most of them are toxic to plant life and must be used with caution. Also, most fumigants must leave the soil quickly, so the soil can be used for seeding purposes. If the fumigant leaves the soil too quickly, the residual nematode population has the opportunity to rapidly build up again.

There is a need for an effective non-phytotoxic nematocide (nematocide non-injurious to plants) to use around the roots of living plants. Established trees, shrubs, and other perennials suffer from nematode infestation because an effective method for controlling the pest is not yet available.

Nematodes are resistant to most chemicals because of the protective covering. The nematode egg is also resistant to most chemicals because of a waxy material that prevents the chemical from penetrating the egg.

As early as 1881, attempts were made to chemically control nematodes. Since World War II scientists have developed fumigants which help control nematodes thereby increasing yields of crops on soils that were once heavily infested with the organisms. Chemicals have brought back into production many acres of fertile land previously abandoned by farmers because the soils would not produce.

The most commonly used nematocides are:

Dichloropropene - Dichloropropane - This nematocide is used primarily for field crops and against all major species of nematodes.

UNIT: Diseases and Control
TOPIC: Chemical Control
(Information Sheet continued)

Ethylene dibromide - This nematocide is used primarily for field treatment but it is ineffective against cyst and root-lesion nematodes.

Methyl bromide - This material is packaged in small cylinders and is recommended for use against many types of nematodes in small areas.

Trichloronitronethane (Chloropicrin) The tear gas is an excellent soil fumigant, but it is also expensive. It is used primarily for seedbeds and potting.

Debromochloropropane (trade name nemagon) - This nematocide is used primarily for seedbed treatment for preplant, at the time of planting and post-plant application. It can be mixed and used in a water solution.

Various soil fumigants are used according to the various types of soils, different types of soil-borne nematodes, and the variation of crops attacked by the pests. Some species of plants are highly sensitive to some chemicals. Label restrictions will indicate how to use others on certain crops. The formulation of fumigants differs in regard to their reaction to specific organisms.

Hardly any area of crop land is free of nematodes or other type of root disease. A nematocide should be used when nematode plant injury and soil infestation have been identified. The presence of plant-parasitic nematodes does not always indicate a need for control. They may be present, but in small numbers which will not cause sufficient damage to require special control measures, especially on crops of low value per acre. Symptoms of nematode infestation can be seen above and below-ground. Plants may show dead buds, seed and leaf galls, crimped stems and foliage, discoloration, root galls, rot, lesions, and leaf spots. The plant laboratory can detect and identify the nematodes by microscopic examination.

D-D soil fumigant is used as a general nematocide. It is less effective against sting and potato rot than the bromides. Ethylene bromide, under the trade name of Dowfume W-85, has been used effectively on cotton, peanut, strawberry, and tree and shrub planting sites.

Fumazone 86 and Nemagon are trade names for 1, 2-dibromo-3-Chloropropane, which are useful in controlling nematodes in peanuts, cotton, strawberries, certain vegetables, and ornamentals.

Chloropicrin is useful for fumigating potting soils and plant seedbeds. The fumes are toxic to plants, especially if the plants are wet. Larvacide or Picfume, the trade names of Chloropicrin, may be used on strawberry, floral crop, and vegetable areas.

UNIT: Diseases and Control
TOPIC: Chemical Control
(Information Sheet continued)

Methyl bromide, when mixed with other fumigants, may be found under the trade names of Dowfume, Bonzone, Pestmaster, Bed-Fume, Trizone. These fumigants can be used on soil areas for trees and shrubs, ornamental nurseries, fruit trees, and vegetables.

Definitions:

Nematocide - a chemical that kills nematodes.
Nematode - a microscopic worm (often called eelworm and roundworm) that seldom exceeds one-eighth of an inch in length.
Fumigant - a solid or liquid that forms vapors which destroy pathogens, insects, fungi, and many other forms of animal and plant life.
Soil sterilization - freeing the soil of microorganisms.
Pathogen - any organism capable of causing disease.
Gall - a pronounced swelling; an out growth, consisting of unorganized cells.

Most of the plant nematodes are inhabitants of the soil. The chemical method used to control nematodes is difficult due to the possibility of injuring the soil for plant growth. The task of destroying the organism is also difficult due to it being soil-borne.

The three methods used to bring a chemical in contact with the organism are as follows:

Use of a chemical - by diffusion through the soil as a gas
By dissolving the fumigant (chemical) in water and then dispersing it through the soil by water
Mechanically mixing the chemical in the soil

Soil conditions must be right for fumigation. First, the soil should be fitted in a condition for planting. It should be well plowed and free of clods; crop refuse should be well decayed, and all trash should be buried. Second, the soil should contain the proper moisture and temperature recommended for the particular fumigant. Third, the fumigant must be properly sealed in the soil to prevent its escape into the air.

Fumigants are applied to the soils by various types of applicators. Applicator kits can be mounted on tractor equipment and include plows, harrows, and cultivators. Custom applicators mounted or pulled behind the tractor make the furrows for the fumigant, deposit the fumigant, cover it, and then apply a broad cover of polyethylene all in one operation.

UNIT: Diseases and Control
TOPIC: Chemical Control
(Information Sheet continued)

If a large area is to be treated, a tooth or chisel method can be used successfully. The chisels are spaced 10 to 12 inches apart behind the tractor. The fumigant is placed six to eight inches into the ground by means of tubes attached to the chisels. The furrow is immediately sealed. Row treatment is similar to broadcast or field treatment but is less expensive. When an area is treated in this way, the fumigant is applied only in narrow strips.

Applying the fumigant by irrigation is one of the safest. Volatile fumigants are mixed in water at a certain number of parts per million. The water should be applied to the area within four to six hours if possible.

Sidedressing established plants can be practiced if Fumazone 70E and Fumazone 86 are used. Power equipment is used for a large area and hand injectors are used for small areas.

Conditions to observe in applying nematocides are:

Dichloropropene - dichloropropane
- Plow under crop residues and let decay.
- Soil should be moist with temperature between 40 and 80 degrees F.
- Soil should be in seedbed condition.
- A chisel applicator should have chisels spaced 12 inches apart. The chemical should be applied 6 to 8 inches below the surface.
- Apply chemical at rate of 20 gallons per acre.
- For row application, use two chisels spaced 12 inches apart. On 3 foot rows it takes 13.3 gallons per acre.
- Immediately after application compact the soil with a float, roller, cultipack or similar sealing device to prevent rapid escape of gas.
- Do not disturb soil for 14 days.
- Plow soil to aerate.
- Use a 30% nitrate solution to protect soil against nitrogen deficiency.

Telone
- Apply at the rate of 16 gallons per acre, chiseled 12 inches apart.
- 3-foot rows require 10.6 gallons.
- Use procedures that are given in No. 1 above.

Ethylene dibromide
- Applied at 4.5 gallons per acre, chiseled 12 inches apart.
- 3-foot rows use 3 gallons per acre.
- Other application procedures are the same as No. 1 above.

Trizone

Apply chemical at the rate of 140 to 200 pounds per acre.
Use 12 inch chisels as in 1, 2, 3 above.
Leave soil covered (tarp) at least two full days and up to five days.
Planting can follow 4 days after cover is removed. Transplanting can begin two to three weeks after cover is removed.

Vorlex

Chisels should be set 6 to 8 inches apart. Apply at a rate of 10 to 60 gallons per acre.
Follow steps in No. 1 above.

Methyl bromide

Apply 2 pounds per 100 square feet under gas tight plastic cover.
Cover should remain in place two days.
Use a nitrate fertilizer as in No. 1.
Methyl bromide should be preheated before using. The container should be heated at 160 to 170 degrees.

Nemagon

Apply at the rate of four gallons per acre.
Use other procedures as listed in No. 1.

Safety Precautions of Nematocides

1. Do not breathe vapors.
2. Keep chemical away from skin and clothing.
3. Do not wear contaminated clothing until it is free of chemical odor.
4. If chemical gets in eyes, flush for several minutes with flowing water and get medical attention.
5. Do not use chemicals in closed areas.
6. Wash skin thoroughly with soap and water after handling chemical.

Bactericides are rather common for control of bacterial diseases in animals. These bactericides can be classified as:

Antibiotics
Sulfa drugs
Furazolidone

UNIT: Diseases and Control
TOPIC: Chemical Control
(Information Sheet continued)

There is more limited use of bactericides in controlling bacterial infection in plants. Generally, the treatments have been of limited success and costly. The antibiotic, streptomycin, has provided some control of fireblight in apples, pears, and walnuts.

The student should get current information on bactericides by obtaining leaflets on specific bactericides from his employer.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Cotton Pickers and Cotton Strippers

OBJECTIVES:
1. To develop an understanding of the different types and sizes of cotton pickers and their rates of work.
2. To develop an understanding of the development of the cotton stripper and its size and rate of work.
3. To develop an understanding of the principal parts of the cotton picker and cotton stripper and how each works.

REFERENCES:
1. Farm Machinery and Equipment, Smith, Ch. 20, pp. 355-381.
2. Machines for Power Farming, Stone and Gulvin, Ch. 34, pp. 511-530.
3. Operator's Manual for equipment being operated.
4. Information Sheet, "Cotton Pickers and Cotton Strippers".

QUESTIONS OR ACTIVITIES

Pickers:
1. Name the four ways of classifying cotton-picking machines.
2. Cotton pickers can be classified according to the way they are mounted, as mentioned in question one. What are 2 ways pickers may be mounted?
3. How many rows will a cotton picker harvest at once?
4. List the 2 heights of picking drums available.
5. What are 2 types of spindles used on cotton pickers?
6. List the principal units of a cotton picker.

Strippers:
1. List the sizes and types of cotton strippers available.
2. Explain the functions of a cotton stripper.
3. There are two main types of cotton strippers, based on the mechanism used for the stripping action. Name these two types.
4. Explain the difference between a roll stripper and a finger stripper.
5. List the two basic mechanisms of the cotton stripper.
6. Give the basic function of the two mechanisms.
7. Name 6 important field adjustments an operator may be required to make on a cotton stripper.

Information Sheet
on
COTTON PICKERS AND COTTON STRIPPERS

Cotton pickers are machines developed to remove locks of seed cotton from the open cotton burr. This type of equipment performs the work that formerly was accomplished by hand. The mechanical features of different brands of machines may be slightly different, but all modern day pickers are self-propelled. The noticeable differences in pickers are the number of rows harvested, type of spindles, height of drums, and types of doffers (plates that remove the cotton from the spindles). Refer to Figure 1.

Some of the basic operating units of a picker include: the power unit, picking unit, fan delivery system, platform, controls, and the cotton basket. The principal parts of these units and their functions are:

> Stalk lifters, spring fingers, and grid bars that move cotton stalks into the picking area. Snouts that are adjustable travel close to the ground.
>
> In the picking unit there are hundreds of spindles carried on spindle bars. Spindles rotate at 90 degrees to the direction of travel as they remove seed cotton from the stalk. A typical machine will have twenty spindles on each vertical bar. The bars are mounted on two drums (one on each side of the row). Spindles rotate and entangle and extract seed cotton from the open boll.
>
> Doffers remove the cotton from tapered spindles after they leave the plant. The stationary rubber face doffers drop the seed cotton so that it can be picked up by air from the conveyor. Cotton from straight spindles is removed by stripper bars as the spindle passes the bar. Doffers do not clean the spindles of dirt, plant sap, and other materials; therefore, the picking unit is equipped with moisture carrying tubes that deliver the water to rubber cleaning pads which clean the spindles.
>
> Cotton is conveyed to the carrying baskets by a fan that draws cotton from the drum through conveyor pipes. Dirt and trash are extracted from the cotton through grates by the air blast before it reaches the carrying baskets.

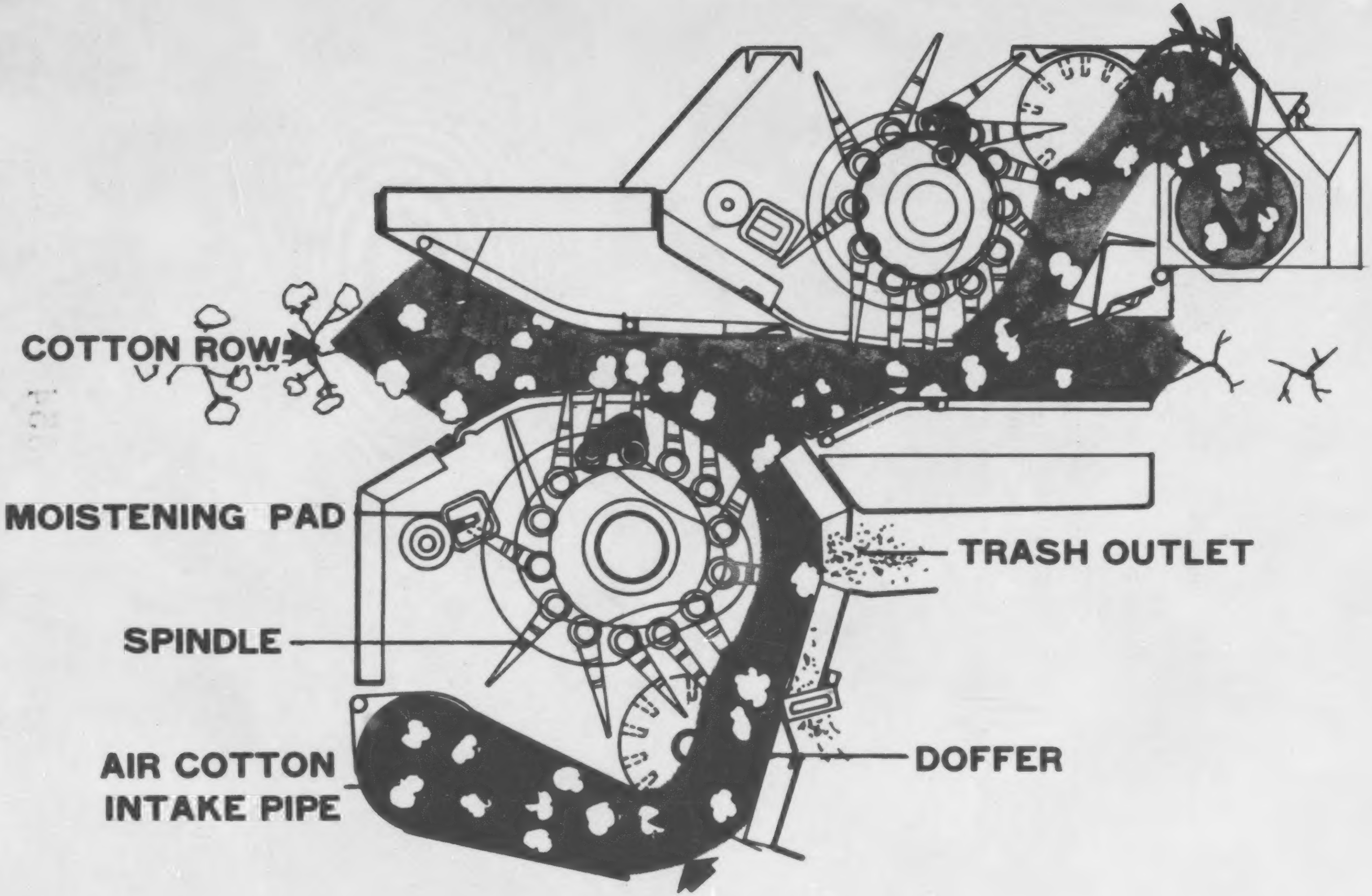
Cotton strippers, as shown in Figure 2, are machines that remove the entire open boll (seed cotton and burr) from the plant. Most strippers are used to harvest stormproof varieties of cotton. The two most commonly used strippers are: single and double roll and line-types. The stripper may also be classified according to the supporting power. For example, a tractor mounted stripper

UNIT: Harvesting Equipment
TOPIC: Cotton Pickers and Cotton Strippers
(Information Sheet continued)

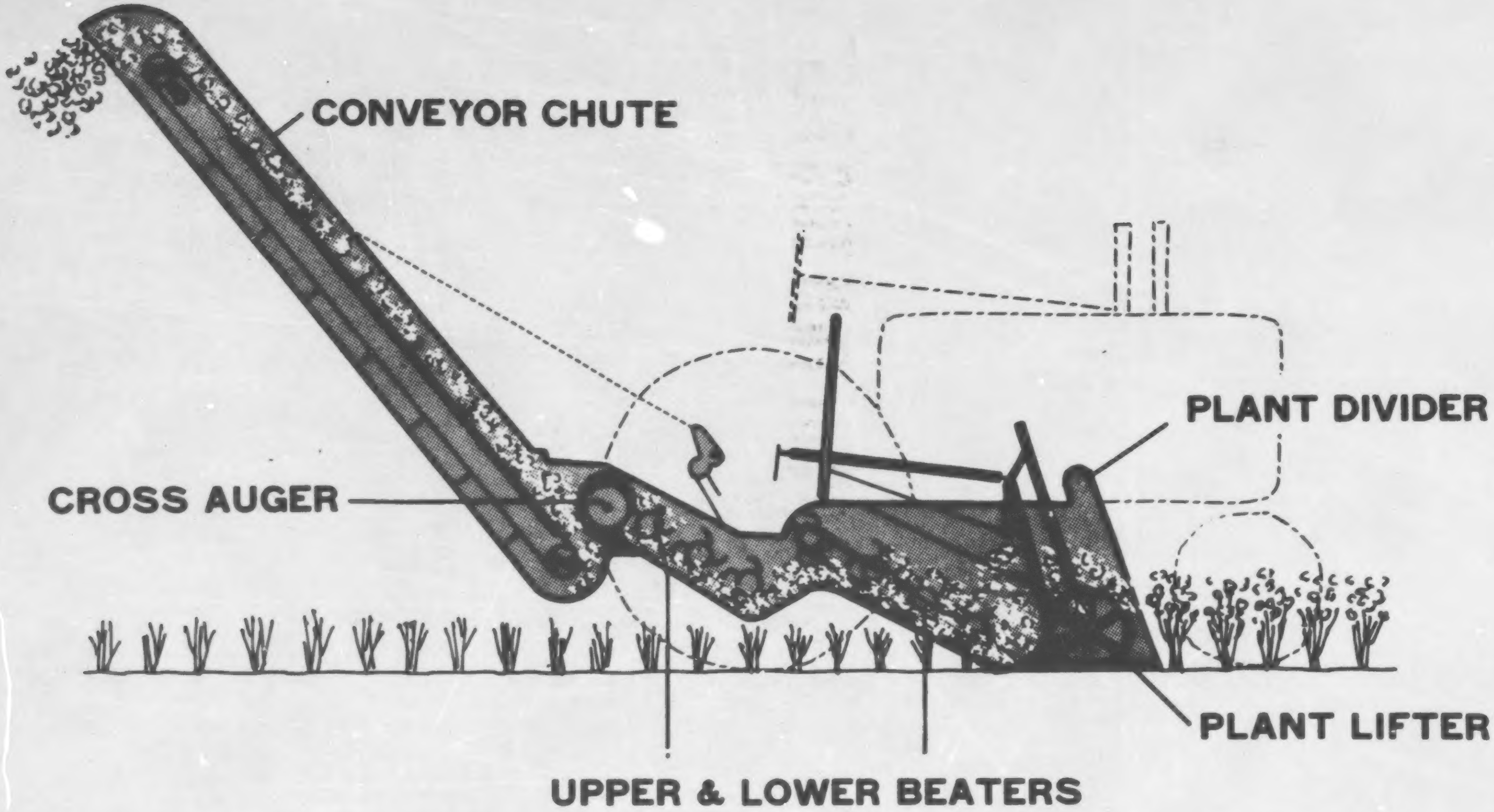
is raised and lowered by hydraulic power. It is powered by the PTO drive. A line-type is pulled by a tractor and the stripping unit is also powered by the PTO drive. The major parts of these two types of strippers include:

> Roll stripper - pick up grates, or lifters, rolls or roll and bar, auger conveyor, pressure plates, fingerbeaters, fan, and conveyor chute.
> Line-type stripper - pick up and stripping fingers, upper and lower beater conveyors, cleaner screen, auger, and conveyor chute.

COTTON PICKING UNIT


COTTON ROW
MOISTENING PAD
TRASH OUTLET
SPINDLE
DOFFER
AIR COTTON INTAKE PIPE

COTTON STRIPPER


CONVEYOR CHUTE
PLANT DIVIDER
CROSS AUGER
PLANT LIFTER
UPPER & LOWER BEATERS

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Corn Snappers, Corn Pickers, Corn Picker-Shellers, and Corn Combines

OBJECTIVES:
1. To develop an understanding of the different machines used to harvest corn.
2. To develop an understanding of how these machines operate.

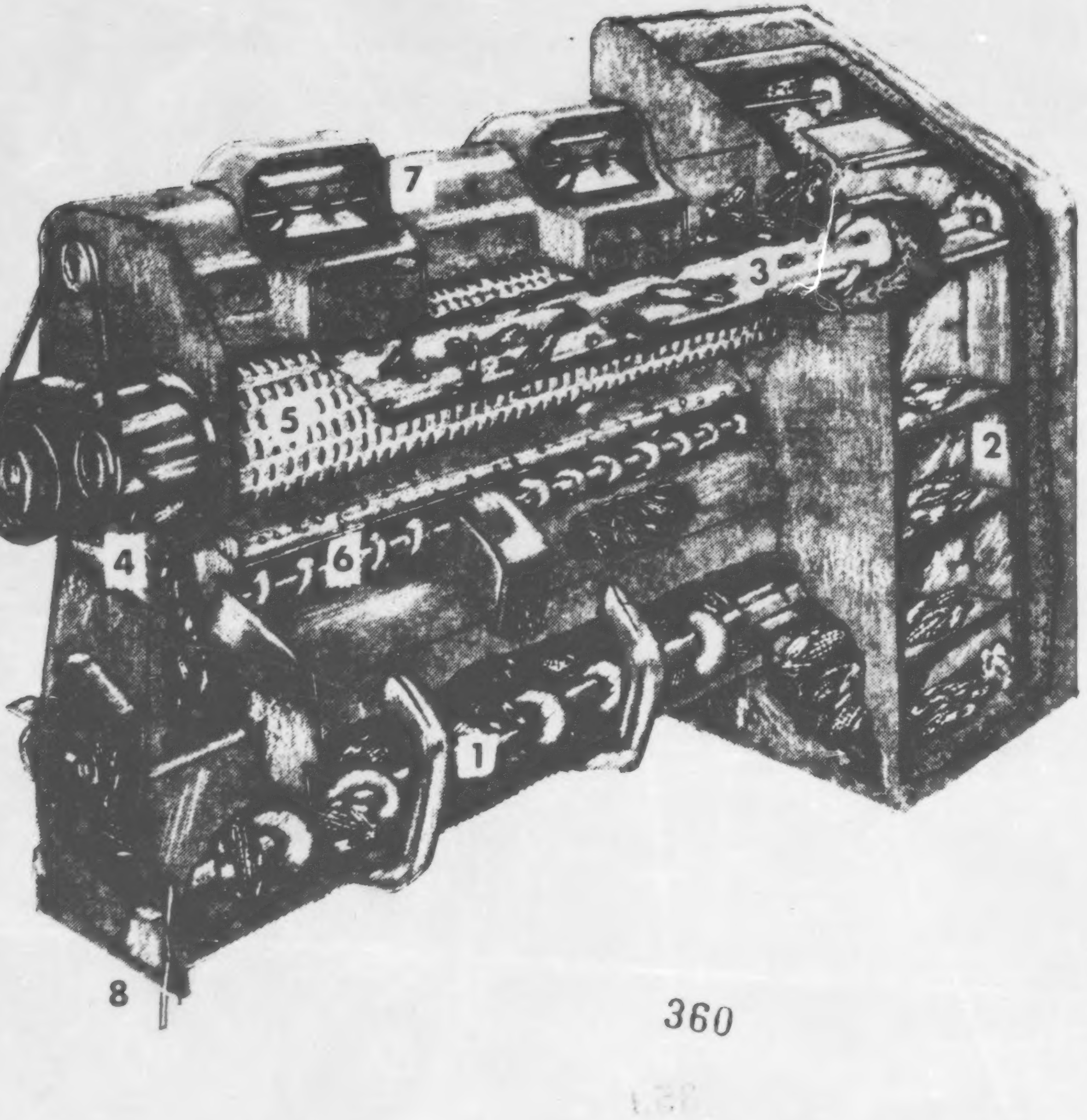
REFERENCES:

Required:
1. Farm Machinery and Equipment, Smith, Ch. 19, pp. 343-353.
2. Machines for Power Farming, Stone & Gulvin, Ch. 33, pp. 492-510.
3. Information Sheet, "Corn Picker-Sheller"
4. Operator's Manual for Equipment being Operated

QUESTIONS OR ACTIVITIES:

1. What are 4 types of machines used for harvesting corn?
2. How does the method of harvesting by these 4 machines differ?
3. What are the 7 basic units of most corn harvesting machines?
4. What general things will affect the performance of a corn harvesting machine?

Information Sheet
on
CORN PICKER-SHELLER
(Working Cross-Section)



UNIT: Harvesting Equipment
TOPIC: Corn Snappers, Corn Pickers, Corn Picker-Shellers,
and Corn Combines
(Information Sheet continued)

1. Husked ears are augered from right and left-hand husking units to the elevating conveyor on the right side of the sheller.

2. The elevating conveyor delivers ears into the right side of the shelling chamber.

3. Ears travel across the full length of the shelling chamber and are exposed to the shelling action of all the lugs staggered along the cylinder. Angled feed paddles on the cylinder rotor keep ears moving.

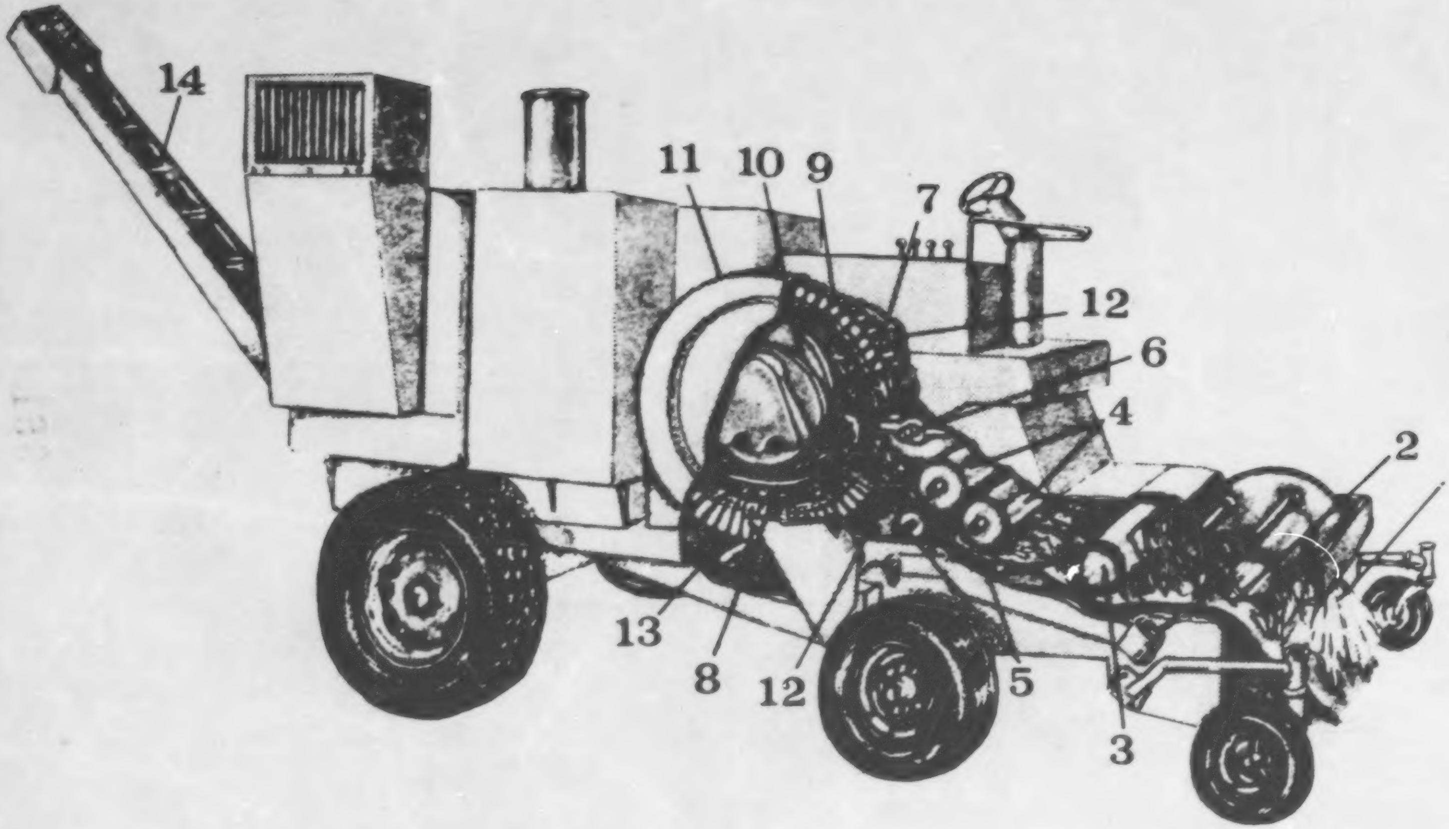
4. Adjustable cob-ejection paddles send cobs and trash out discharge chute on the left rear of the sheller.

5. The cylindrical steel concave has perforations through which corn falls to the perforated auger trough. A stationary retarder on the upper part of the concave and an adjustable retarder on the lower part regulate ear flow for thorough, full-length shelling.

6. The shelled corn auger, beneath the concave, carries corn to the center, then delivers it into the picker wagon elevator.

7. Two high-volume, suction-type cleaning fans draw air the full length of the sheller. Fans clean corn as it falls through the concave into the auger trough and again as it travels across the perforated auger trough on its way to the elevator.

8. A roller chain from the picker gear case drives the sheller. All drives are roller chain except the V-belt fan drive. A friction slip clutch protects the rotor.



UNIT: Harvesting Equipment
TOPIC: Corn Snappers, Corn Pickers, Corn Picker-Shellers,
and Corn Combines
(Information Sheet continued)

How a Cube Machine Functions

After the forage crop is field-cured, it is picked up by the machine and sprayed with water (1). The windrow is conveyed to the machine by the conveyor and cylinders (2). An auger located behind the feeder (3) feeds the crop to the feed rolls. Drum rolls (4) are on top and smooth rolls (5) are on the bottom. The smooth rolls help reduce leaf loss.

A two-knife cutterhead (6) cuts the crop into small pieces, mixes the plant parts and delivers the material to a feeder auger. The auger (7) and the spiral bars (8) move the chopped plants to the openings in the die ring (9). As the material leaves the auger it is forced into the die openings by a large press wheel (10). The deflector (11) around the die ring breaks off the cubes.

Metal chutes (12) channel the cubes to a conveyor (13) beneath the die ring. The conveyor carries the cubes to the elevator (14). The cubes are delivered into a trailer or trailing wagon.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Forage Harvesting Equipment--Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment

OBJECTIVES:
1. To develop an understanding of the different types of machines used to harvest forage crops.
2. To develop an understanding of how these machines work.

REFERENCES:

Required:
1. Machines for Power Farming, Stone and Gulvin, pp. 387-469.
2. Farm Machinery and Equipment, Smith, pp. 289-328.
3. Information Sheet, "Forage Harvesting Equipment".
4. Operator's Manual for equipment being used.

QUESTIONS OR ACTIVITIES:

Mowers:
1. What are the 3 main types of mowers?
2. List the major parts of a mower.
3. What is the function of the frame?
4. Name the parts of the cutter bar assembly.
5. Name the parts of the mower drive.

Rakes:
1. Name the 3 different classifications of hay rakes.
2. What are the 4 types of side-delivery rakes available?
3. Give the function of the side-delivery rakes available.
4. What are the major parts of a side-delivery rake?
5. Name the parts of the reel assembly on a side-delivery rake.
6. Give the 5 methods of adjusting the reel and basket.
7. What are the two main types of drives available on the side-delivery rakes?

Hay Conditioners:
1. Name 3 ways of conditioning hay.
2. What are the advantages of conditioned hay?
3. List the 3 general types of hay conditioners.
4. Explain how each of the above 3 machines condition hay.

UNIT: Harvesting Equipment
TOPIC: Forage Harvesting Equipment—Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment
(Assignment Sheet continued)

Windrowers:
1. What are the two types of windrowers?
2. List the operations performed by most windrowers?
3. What 3 implements or operations do the windrowers replace?
4. Name the 2 main parts of the cutting mechanism.
5. Name the 2 main ways hay is conveyed to the center of the header.

Balers:
1. List the 2 main types of balers.
2. What are the two types of tying materials used to tie bales?
3. Give the two types of power sources for balers.
4. How is the capacity of a baler expressed?
5. Give the 2 different types of balers according to shape of bale.
6. List 2 reasons why the size of the bales is important.
7. What are the 4 processes involved in making a bale with a baler?
8. Describe how the pickup unit operates.
9. List the 4 main methods of feeding hay into the compressing chamber.
10. Name the 5 parts of the compressing mechanism.
11. What are the 3 parts which make up the chassis of a baler?

Silage Choppers:
1. Give the purpose of the forage harvester.
2. What are the two types of forage harvesters which have been developed?
3. List the 3 types of field choppers used by farmers.
4. What are the basic units which go to make up a field chopper?
5. What are the 3 processes involved in the operation of the forage harvester?
6. Name 3 attachments available for the forage harvester.
7. What are the 2 principal types of cutter heads used on forage harvesters?

Wafering Equipment:
1. What has increased the use of wafering equipment?
2. Explain how the wafering process works.

Information Sheet
on
FORAGE HARVESTING EQUIPMENT

Windrowers

The windrower is relatively new compared to other types of hay equipment. The purpose of the windrower is to place quality hay in a windrow. It does this by combining three operations: mowing, conditioning, and raking.

The windrower can be of two types: trailing or self-propelled. The trailing is powered by the PTO from the tractor. It is usually smaller in size, and depending on the condition, can cut, condition, and windrow about 30 to 50 acres per day. The trailing type of machine is usually used by landowners rather than custom operators. The second type of windrower is the self-propelled. It contains its own power source. This machine is larger and can cut, condition, and windrow about 80 acres per day depending on the conditions. Most custom operators use this machine.

As we have said before, the windrower combines three operations into one. It cuts, conditions, and windrows the hay. In most cases this eliminates two previous operations: mowing and raking. The rake will still be needed sometimes to turn the windrow so the hay will dry. Operators have said that the windrow will wliminate one driver and one tractor.

The windrower consists of three mechanisms: the cutting, feeding, and conditioning.

The cutting mechanism cuts the hay and consists of a cutter bar and reel. The cutting mechanism of a windrower is very similar to the cutting mechanism of a combine. The hay is then conveyed to the header by a canvas or auger, where the crimper or rollers condition the hay and place it in a windrow behind the machine.

For additional information review Topics 1-Mowers, 2-Rakes, and 3-Conditioners. These topics will give the necessary background for studying the windrower.

Balers

Two types of balers used to bale hay are:

1. Pickup automatic self-tying balers which make rectangular bales.
2. Pickup automatic baler making round bales.

UNIT: Harvesting Equipment
TOPIC: Forage Harvesting Equipment--Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment
(Information Sheet continued)

Four processes involved in making a bale with a baler are:

1. Pickup
2. Feeding
3. Compressing
4. Tying

The usual type of pickup mechanism on the baler consists of a drum or cylinder with spring steel teeth. The cylinder rotates in the opposite direction of the motor of the baler, lifting the hay and moving it into the machine.

At least four main methods of feeding the hay into the compressing chamber are commonly used on balers. They are:

1. Auger and packer fingers
2. Spring teeth and feeder arms
3. Auger and feeder head
4. Carrier-roller feed

The feeding mechanism on the baler feeds the hay into the compressing chamber where the hay is pressed into a bale. The compressing mechanism is composed of five parts:

1. Plunger
2. Bale chamber
3. Tension bars or rails
4. Retaining plates
5. Metering wheel

On the rectangular bale, the plunger is a rectangular framework that pushes against the hay as it is fed into the compressing chamber. The plunger has a set of knives along the side next to the feeding mechanism. These knives shear off the hay as it is fed into the compressing chamber making a neat, smooth bale.

The bale chamber is the long rectangular box into which the plunger forces the hay. The tension bars or rails are located in the chamber and offer resistance to the plunger action making a tight bale.

The retaining plates are located in the compressing chamber just out of reach of the plunger. They prevent the bale from moving back toward the plunger after each compression stroke.

UNIT: Harvesting Equipment
TOPIC: Forage Harvesting Equipment--Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment
(Information Sheet continued)

The metering wheel is located on the compressing chamber and the spokes make contact with the hay. As the hay moves through the compressing chamber, it turns the metering wheel. After making a complete turn, the metering wheel engages the tying mechanism.

The last function performed by the baler before it releases the bale is that of tying the bale. The tying function is described on pages 442 and 443 of Machines for Power Farming and 309-311 of Farm Machinery and Equipment.

On the round baler, the hay is fed into a series of rolling belts. The lower set of belts operate in the opposite direction from that of the upper series of belts. The hay is turned in a circular motion forming a round bale. After the bale becomes so large, it trips the trip rollers and releases the bale. (See Farm Machinery and Equipment, page 312, for an illustration of how the roller baler operates.)

Forage Harvesters

The primary purpose of forage harvesting machinery is to chop field crops and place the chopped crop in a wagon. Two types of forage harvesters have been developed to accomplish this purpose.

1. Field chopper
2. Flail chopper

The field chopper is by far the most versatile of the two types. This versatility comes from its ability to be adapted to a variety of crop or forage production methods. For example, a unit has been developed for use in harvesting row crops, a unit for picking up forages in the windrow, etc. (See Farm Machinery and Equipment, page 320, for examples of unit attachments for the forage chopper.)

There are three types of field choppers used by farmers.

1. Tractor-drawn
2. Tractor-mounted
3. Self-propelled

UNIT: Harvesting Equipment
TOPIC: Forage Harvesting Equipment---Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment
(Information Sheet continued

The basic unit of the field chopper is made up of the following parts:

1. Wheels
2. Axle
3. Frame
4. Cutter head
5. Blower
6. Feeding mechanism

This unit is powered through the PTO and the tractor. The power from the PTO shaft is carried to the basic unit through the PTO shaft in the harvester.

Three processes are involved in the operation of the forage harvester.

1. Cutting and feeding
2. Chopping
3. Blowing

The feeding and cutting mechanism will vary according to the type of unit attachment being used on the harvester. If a row crop unit is being used, an oscillating sickle is used to sever the plants. The plants are moved back toward the chopping unit. If a broadcast unit attachment is used, a mower-like cutter-bar cuts the crop. A reel is used to throw the severed plant against an apron which carries the forage back to an auger. The auger in turn carries the material to the chopping unit. If a windrow pick-up is used, revolving fingers lift the forage from the windrow and move the hay to the auger. The auger in turn moves the forage to the chopping mechanism.

Two principal types of cutter-heads are used on forage harvesters.

1. Flywheel
2. Cylinder

The flywheel-type cutter-head performs two functions: chopping and blowing. The blower-paddles are separate from the cutter-knives. As the wheel turns, the knives cut the forage and the blower-paddles blow the chopped forage up and out of the blower spout.

The cylinder type of cutter-head has knives designed to both cut and blow: however, some require a blower to force the chopped forage out of the harvester. (See Farm Machinery and Equipment, page 322 for an illustration of both types of cutter-heads.)

UNIT: Harvesting Equipment
TOPIC: Forage Harvesting Equipment---Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment
(Information Sheet continued)

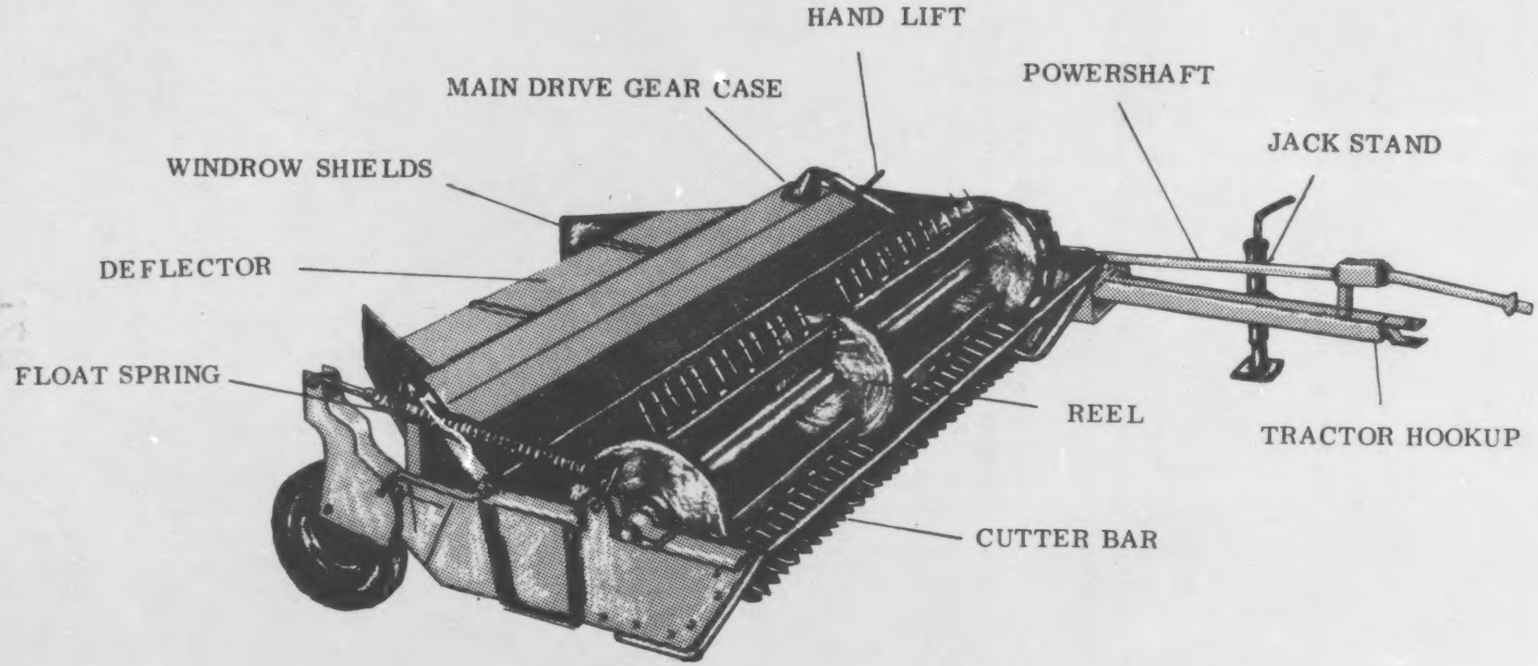
The flail type harvester uses free-swinging chains, hammers, or knives to sever the plants through a beating or cutting action. The chopped hay is drawn into the blower fan and blown through the blower spout into the wagon.

Cubers

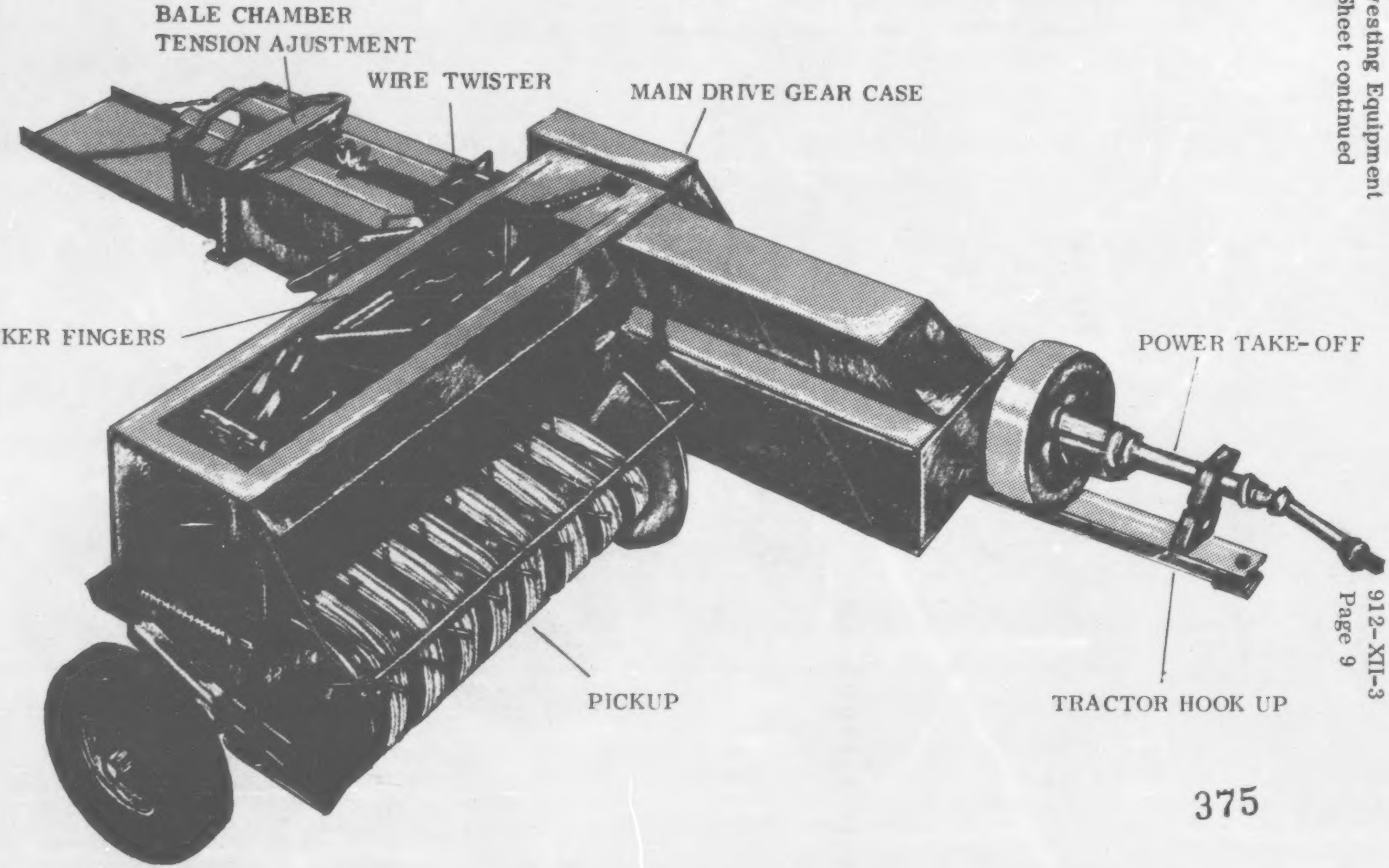
There are two major types of cubers, the stationary type and the mobile type. The mobile cuber produces cubes from alfalfa after it has been field-cured to about 10 percent moisture.

The alfalfa plant is cut, raked into windrows, and picked up by the cuber. Drum-type rollers carry the plant to a water sprayer on the cutter-head, where the hay is chopped and moved to a die ring. A large press wheel forces the material through die openings, forming the cubes.

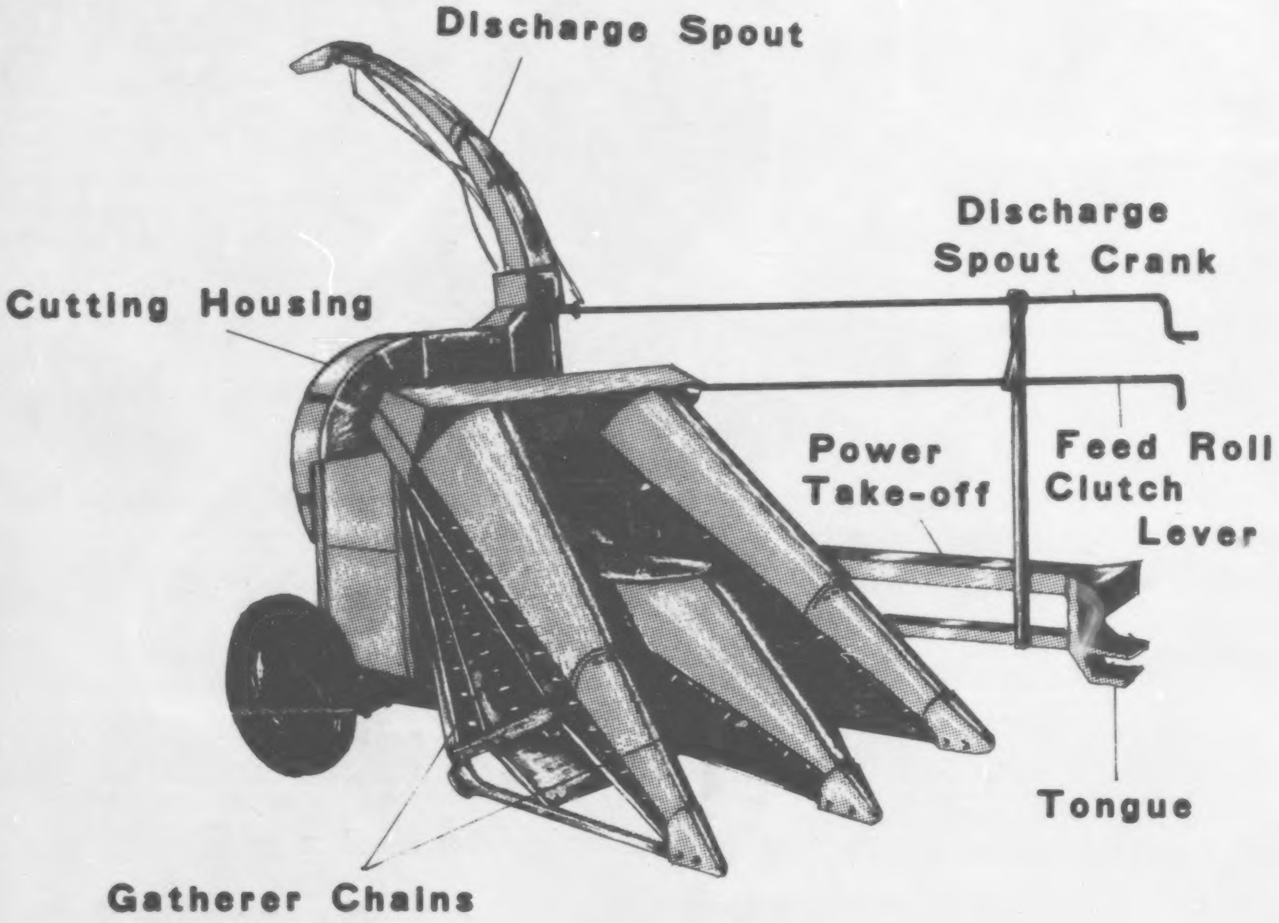
MOWER AND CONDITIONER


HAND LIFT
MAIN DRIVE GEAR CASE
POWERSHAFT
JACK STAND
WINDROW SHIELDS
DEFLECTOR
FLOAT SPRING
REEL
TRACTOR HOOKUP
CUTTER BAR

HAY BALER


BALE CHAMBER
TENSION AJUSTMENT
WIRE TWISTER
MAIN DRIVE GEAR CASE
PACKER FINGERS
POWER TAKE-OFF
PICKUP
TRACTOR HOOK UP

FORAGE HARVESTER


Discharge Spout
Discharge Spout Crank
Cutting Housing
Power Take-off
Feed Roll Clutch Lever
Tongue
Gatherer Chains

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Combines

OBJECTIVE: To develop an understanding of the combine and how it operates.

REFERENCES:

Required:

1. Farm Machinery and Equipment, Smith, Ch. 18, pp. 329-340.
2. Machines for Power Farming, Stone & Gulvin, Ch. 32, pp. 470-491.
3. Information Sheet, "Combines".

QUESTIONS OR ACTIVITIES:

1. List the 2 general types of combines available today.
2. List the 6 basic operational functions of a combine.
3. Give the paths of progress or steps in history which lead to the combine of today.
4. How are combine sizes expressed?
5. List the principal units of a combine.

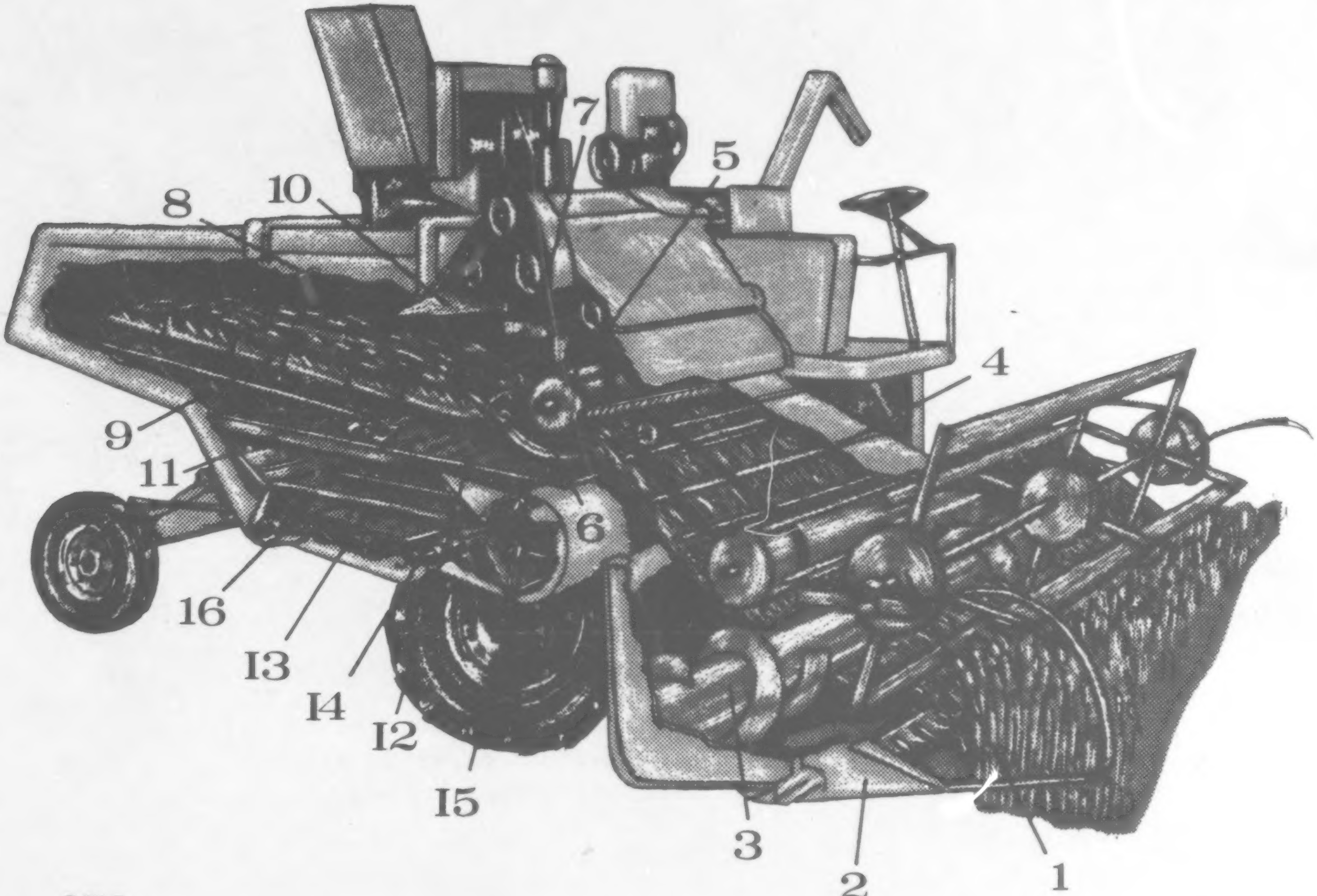
Information Sheet
on
THE COMBINE

Operating Cycle

The reel (1) momentarily holds the crop against the guards until the knife (2) cuts the stems, and then it sweeps the cut material onto the platform. The platform auger (3) delivers the cut grain to the feeder (4) which carries the cut grain to the cylinder (5). The grain is rubbed out of the head between the rotating cylinder (5) and the concave grates (6). The cylinder beater (7) strips the cylinder, continues separating loose kernels of grain through the finger grate (8) then moves the material onto the straw rack (9) where final separation takes place. The adjustable cylinder beater check flap (10) regulates the flow of material over the racks. The grain pan (12) catches the grain separated at the concave, cylinder beater grate, and return from the straw racks and delivers it to the chaffer (11). The cleaning fan (15) supplies the wind blast which is the medium of separation. The shoe and sieve (13) operates directly opposite to the grain pan and chaffer which assures double action cleaning (as the grain pan and chaffer moves forward, the shoe and shoe sieve move towards the rear.) The shoe sieve (13) is where the final cleaning takes place. The threshed grain falls through the chaffer, and shoe sieve, and into the grain trough (14) where it is moved to the grain elevator by the grain auger. The grain elevator conveyor chain then delivers the clean grain to the grain tank. Unthreshed heads will move rearward across the chaffer and shoe sieve and drop into the tailings return auger trough (16). From this point, the unthreshed heads are returned by the tailings elevator to the cylinder for re-threshing.

1. Reel
2. Knife
3. Platform auger
4. Feeder
5. Cylinder
6. Concave gates
7. Cylinder beater
8. Finger gate
9. Straw rack
10. Cylinder beater check flap
11. Chaffer
12. Grain pan
13. Shoe sieve
14. Grain trough
15. Cylinder fan
16. Auger trough

COMBINE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Information for Instruction
on
COMBINES

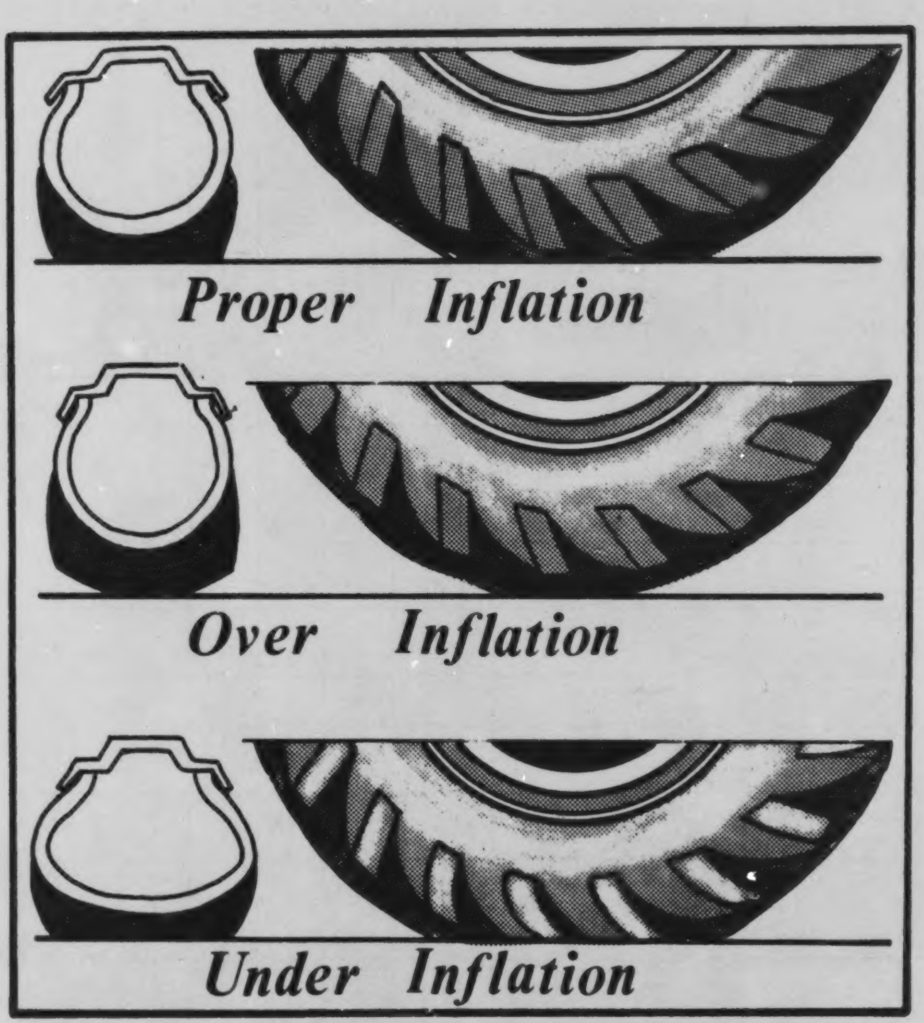
Man-hours Required to Harvest 1 Acre of Wheat
(Courtesy International Harvester Co.)

Cutting with sickle	14 hr.	Cutting with cradle	5 hr.	Cutting with McCormick's first (4 1/2 ft) reaper	2 hr.	Cutting with 5-ft. grain binder	3/4 hr.	14 ft. combine	1/2 hr.
Binding by hand	5 hr.	Binding by hand	5 hr.	Binding by hand	5 hr.	None		None	
Shocking	1 hr.	Shocking	1 hr.	Shocking	1 hr.	Shocking	1 hr.	None	
Threshing with flail	13 hr.	Threshing with flail	13 hr.	Threshing with flail	13 hr.	Stationary thresher	1 1/4 hr.	None	
Winnowing rod and sheet	10 hr.	Winnowing rod and sheet	10 hr.	Winnowing rod and sheet	10 hr.	None			
Gathering and sacking	3 hr.	Gathering and sacking	3 hr.	Gathering and sacking	3 hr.	None		None	
	46 hr.		37 hr.		34 hr.		3 hr.		1/2 hr.

Versatility of Combine

CROP	SPECIAL SIEVE (OPTIONAL)	RECOMMENDED EXTRA EQUIPMENT															
		Bean Concaves	Bean Elevator	Clover, Alfalfa Concaves	Corn Head	Cylinder Filler Bars	Fan Dirt Shield	Fan Housing Shield	Fan Inlet Screen	Perforated Grain Pan	Perforated Shoe Floor	Pickup Unit	Roto Cleaner with Proper Screen	Rub-bar Concave Fillers	Slow Cylinder Speed Sprockets	Stone Trap	Wide Rear Axle
Alfalfa	3/32" *			X									X				
Barley													X				
Corn	3/8" * 5/8" *				X	X		X									X
Edible Bean	3/8" * 1/2" *	X	X			X	X			X	X	X	X		X	X	X
Soy Beans	3/8" * 1/2" *												X			X	X
Sugar Beet	9/32" *												X			X	X
Clover	3/32" * 1/8" *			X									X	X			
Flax	3/16" * 5/32" *										X	X	X				
Grasses	1/8" x 3/4" a 1/8", 5/32", 3/32", 5/64"*																
Grain Sorghums	1/8" x 3/4" a 9/32" *																
Oats									X			X	X				
Field Peas	3/8" * 1/2" *									X	X					X	X
Rice	1/2" * 5/8" *												X				
Rye	1/8" x 3/4" a												X				
Wheat	1/8" x 3/4" a								X				X				

* - Round Hole
a - Oblong Hole


Proper Inflation
Over Inflation
Under Inflation

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Small Grain Drills and Spin Broadcast Seeders.

OBJECTIVE: To develop an understanding of small grain harvesting equipment.

REFERENCES:

Required:

1. Farming Machinery and Equipment, Smith, Chp. 16 and 18, pp 289-314 and 329-340.
2. Machines for Power Farming, Stone and Gulvin, Chps. 27, 28, 29, 30, 32, pp. 387-449, 470-491.
3. Information Sheet, "Small Grain Drills and Spin Broadcast Seeders".

QUESTIONS OR ACTIVITIES:

1. What determines the methods used for harvesting small grains?
2. What should be considered before cutting small grains for grain?
3. What should be considered before baling small grains?
4. Is grazing small grains a good way to harvest?

Information Sheet
on
SMALL GRAIN DRILLS AND SPIN BROADCAST SEEDERS

Grain drills and spin broadcast seeders are used to sow most of the small grains, grasses, and legume seed. This type of equipment is used to plant such crops as oats, barley, rye, wheat, many of the sorghums, alfalfa, clover, and other high-population crops. Grain drills are considered more accurate in seeding than a spin type spreader. They can also place seed below the surface for better germination. Large seed such as wheat, barley, oats, and sorghums must be placed in moist soil for proper germination. Yet, many of the cultivated grasses and legumes can be successfully planted by sowing the seed on the surface of a prepared seed bed.

Grain drills may be classified according to the feed mechanism and the depth of seeding. The two main types of feeding mechanisms (metering devices) are the fluted force feed and the internal double run. Most drills are dual purpose; that is, they can be used to sow seed on the surface or at different depths in the soil. These drills are classed as surface or deep-furrow drills. Both types usually place the seed in narrow rows.

The major parts of a drill are:

Hopper
Seeding mechanism
Seed tubes
Furrow openers
Driving device

Frame
Dragbars
Wheels
Covering devices
Firming device

Most grain drills are driven by the drill wheels whether they be end-wheels or press wheels. Press-wheel drills are used in areas where it is necessary to conserve moisture by pressing the soil against the seed.

Many broadcast or spinner seeders have adjustable blades that regulate the spreading of seed on the prepared ground. The two main types of these spreaders are the centrifugal and full-width-feed. These spreaders are made to mount on a three point hitch on the tractor or pull-type. The spinner/s is usually operated by the PTO. The main parts of these types of spreaders are:

Hopper
Agitator

Frame
Disk/s or spinner/s

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Cotton

OBJECTIVE: To develop an understanding of the economic importance of cotton as a major crop in Texas.

REFERENCES:

Required:

1. "Cotton Insects", Texas Agricultural Extension Service, B-933.
2. Plant Science, Janick and others, pp. 567-571.
3. Information Sheet, "Cotton".

QUESTIONS OR ACTIVITIES:

1. Give a brief history of cotton as a crop.
2. What are the uses of cotton?
3. What are some natural hazards to cotton production?
4. Name 10 plant characteristics which should be considered in selecting a variety of cotton.
5. Name 5 fiber properties which should be considered in selecting a variety of cotton.
6. What nutrient is cotton most responsive to?
7. When should cotton be planted?
8. How much fuzzy, mechanical, delinted, and acid delinted cotton seed should be planted per acre (average)?
9. What are the reasons for cultivating cotton?
10. What equipment is used for cultivating cotton?
11. How much water is required for normal cotton production?
12. How is most cotton harvested today?
13. Explain the difference between true defoliants, defoliant-desiccants, and true desiccants.
14. What methods are used to defoliate cotton?
15. What are the major insects attacking cotton?
16. What are the minor cotton insects?
17. What are some beneficial insects for cotton?
18. Explain how insect counts are made. Use the bollworm as your example.

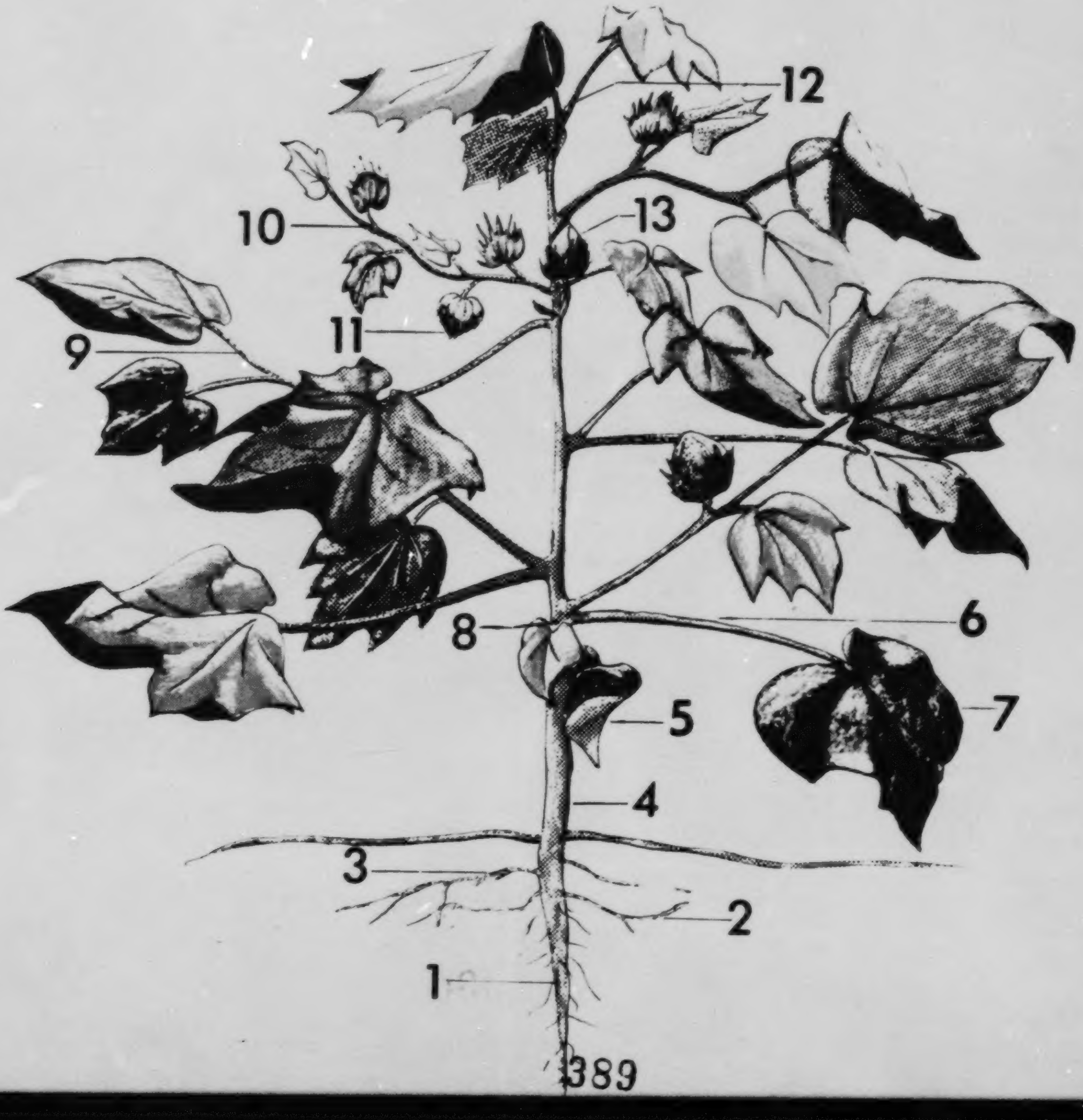
UNIT: Major Crops
TOPIC: Cotton
(Assignment Sheet continued)

19. What are the major diseases attacking cotton in Texas?
20. What is meant by classification of cotton?
21. What is meant by grade?
22. What are the grades and symbols used for white cotton?
23. What are the codes for staple length, and what is the equivalent length for each code?

Information Sheet
on
COTTON

Basic Structure of the Cotton Plant

1. Tap (main) root. 2. Root hair (feeder roots). 3. Lateral (branch) root. 4. Main stem (stalk). 5. Cotyledonary node and cotyledons (seed leaves). 6. Main stalk leaf petiole. 7. Main stalk leaf blade. 8. Main stalk node (joint). 9. Vegetative branch (leaves only). 10. Fruiting branch (leaves alternating with fruit). 11. Square (floral bud) that develops into the flower and eventually the boll. 12. Terminal bud or growing apex of shoot. 13. Young boll.



UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

Growth and Fruiting Habits of Cotton in Central Texas

1. Time to come up--average 7 to 10 days, range 7 to 30 days.
2. Appearance of third leaf (first true leaf)--8 days after emergence.
3. Appearance of fourth leaf (second true leaf)--9 days after emergence.
4. Emergence to square--35 to 40 days.
5. Square to white bloom--20 to 25 days.
6. Bloom to open boll--50 to 65 days.
7. Boll full grown--20 to 25 days after bloom.
8. Should be ready to harvest in 160 days (25 per cent open in 130 days).
9. Number of seed in one bushel of average seed--120,000.
10. Most effective fruiting period--June 20 to August 1.
11. Approximately 35 to 40 per cent of blooms make bolls.
12. August 20 generally the last date for normal setting of fruit.
13. Boll period--45 to 65 days.
14. Fiber length laid down first 25 to 30 days.
15. Critical period in length of fiber--16 to 20 days after blooming.
16. Strength of fiber built up in second 25 to 30 days of boll development.
17. Moisture is the limiting factor in determining length of lint in a given variety.
18. Average number of days to blooming peak--90.
19. Average number of days from first bloom to peak of blooming--35.
20. Average number of days from first bloom to shed peak--40.
21. Average percentage of blooms shed--60 to 65.
22. Average number of blooms per plant--40 to 45.
23. 30 per cent of crop open--65 to 75 days after first white bloom.
24. 70 per cent of crop open-85 to 95 days after first white bloom.
25. 85 per cent of crop open--95 to 105 days after first white bloom.
26. Plant population per acre, 40-inch rows--1 plant per foot of row, 13,068 plants; 2 plants per foot of row, 26,136 plants, etc.

Uses of Cotton and Cottonseed Products

COTTON FIBER

Cotton has been grown for its fiber for thousands of years. Cotton culture apparently developed in India and America about the same time, perhaps as early as 1500 B.C. Cotton is the world's most important textile fiber. The cotton plant is unique in that it produces a greater amount of human food and animal feed than it does of cotton fiber.

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

Cotton furnishes about 66 percent of the total mill consumption of fibers in the United States. The fiber is woven into various kinds of fabrics and materials, which have innumerable uses. Because of its many excellent qualities, such as durability, strength, porosity, color fastness, and comfort, cotton is the most-used fiber in the world.

Uses of cotton fiber are in three broad groups: apparel, household, and industrial. The apparel group includes apparel of all kinds for men, women, and children. Household uses include bedspreads, blankets, comforts, quilts, curtains, draperies, piece goods, rugs, carpets, sheets, sewing thread, towels and toweling. Industrial uses include seat covers, upholstery, tire cord, awnings, bags, cordage, twine, industrial thread, mattresses, tarpaulins, tents, and many other items. The consumption of cotton is increasing for certain uses, especially for print cloth, sheeting, toweling and fine dress fabrics. About 8,000,000 bales of cotton are used annually to supply cotton products for the American people.

New manufacturing processes and findings from chemical research have been used during the past few years to produce entirely new cotton fabrics. These new fabrics are more versatile, have improved appearance, and require less effort and money for their care.

Cotton fabrics available now may be washed and worn with little or no ironing. Others are wrinkle-resistant. Some are durably crisp while others have a high luster. Textured cottons have interesting surfaces. Knitted cottons shed wrinkles and resist stretching and sagging.

When cotton fabrics are treated properly with thermosetting resins, they become wrinkle-resistant and may be machine-washed, tumble-dried and ironed lightly. If an increased amount of resin is used, the fabrics may be washed and worn with little or no ironing. These are known popularly as minimum-care fabrics.

Durable crispness is given to organdies and similar fabrics which are popular for wedding and party dresses, curtains and bedspreads. Such fabrics are washed and ironed easily and require no additional finish.

Polished cottons are given a high or low luster by mechanically buffing the fabric after the application of the thermosetting resins. Chintz is one example of a fabric with a high luster and many other clothing fabrics are given a subdued luster.

Many textured cottons are embossed by mechanical action after the resins are applied.

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

The design is fixed at high temperatures. Embossed fabrics should not be ironed since the design may be altered by the action of pressure and high temperatures.

Dimensional stability of modern cotton knitted goods is obtained by the use of resins which increase resistance to stretching, sagging, shrinking, and wrinkling.

Winter cottons, as the name implies, are designed for use in cold weather. They are heavier than other cottons and are woven or knitted to give a bulky, warm appearance, but usually are light in weight. Velveteens and tweeds are popular winter cottons used in men's, women's, and children's clothing as well as in home furnishings.

COTTONSEED

Although cotton is grown primarily for its fiber, cottonseed is an important by-product of cotton production. The total farm value of cottonseed in the United States is about 17 percent of the farm value of cotton fiber (lint). On the average, American cottonseed consists of 10 to 15 percent linter, 35 to 40 percent hulls and 50 to 55 percent meats.

In the processing of cottonseed by hydraulic mills, 1 ton of cottonseed yields about 310 pounds of oil, 925 pounds of cake or meal, 515 pounds of hulls, 135 pounds of linters and 115 pounds of waste.

COTTONSEED OIL

The oil content of cottonseed varies considerably, depending on the variety and the locality where grown. The average yield of oil is approximately 310 pounds per ton of whole seed. Practically all cottonseed oil produced in the United States is used in the manufacture of various food products.

Cottonseed oil as a food product has many superior qualities. It is especially favored for frying because of its high smoking temperature. It is used extensively in making shortening, margarine, mayonnaise, salad dressing, mellorine and packing oil. Cottonseed oil far outranks other oils in the volume used in making this group of products.

CAKE AND MEAL

Approximately 925 pounds of cake or meal are obtained from 1 ton of cottonseed.

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

A large part of the press cake, as such or broken into smaller pieces, is sold as livestock feed. The remainder is ground into cottonseed meal, which is graded and sold on the basis of its protein content. Cottonseed meal is graded according to the protein content. The most popular grades reflect 36, 41, and 43 percent protein. The high protein content of cottonseed cake and meal makes it valuable livestock feed. Sometimes cottonseed meal is used as a nitrogenous fertilizer. A small amount of meal is used in bread, cake, and crackers.

HULLS

On the average, 1 ton of cottonseed yields about 515 pounds of hulls, which are used mainly as a bulk feed for livestock, especially for cattle. The hulls also are used to some extent in the chemical industries, such as petroleum refining, and making of plastics and synthetic rubber.

LINTERS

In the processing of cottonseed for oil, the fuzz, or short fiber, is removed from the seed and is known as linters. The highest grades of linters are used in making coarse products, such as carpets, absorbent cotton and other medical supplies, twine and wicks. Linters are also used as filler for mattresses and comforts, and for furniture and automobile upholstery.

Linters are composed principally of cellulose, which is an important basic raw material for various chemical industries. Linters, when made into linter pulp, are used in the manufacture of a large number of products. Linter pulp is used extensively in making high-tenacity rayon for cord tires, acetate rayon, plastics, lacquers, explosives, fine writing paper, sausage casings, pens and pencils.

Hazards That Affect Cotton Production

CLIMATIC CONDITIONS

The most favorable weather conditions for growing cotton are as follows: A frostless season between 150 to 200 days, mean temperature not below 75 degrees during the summer, adequate but not excessive moisture during growing season and a dry harvest season.

PLANT PESTS

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

Cotton is susceptible to many plant diseases. One of the most dreaded is cotton root rot. Varieties have been developed that are resistant to most diseases, but cotton root rot is an exception. The fungus disease tends to attack all varieties.

An infestation of cotton insects can reduce the yield or completely destroy a cotton crop. The cotton boll weevil is considered most destructive insect pest, especially in areas where the annual rainfall exceeds 25 inches.

Weeds are considered a hazard in most cotton producing regions in Texas. They are competitors for nutrients and moisture. Most weed and grass seedlings are destroyed annually by spraying the soil and/or weeds with a herbicide.

Factors in Selecting Cotton Varieties

Three groups of factors should be considered when selecting a variety of cotton. These groups are plant characteristics, fiber properties, and seed components.

Plant characteristics:

1. Yield ability - a major factor but should not be the only factor considered.
2. Percentage of lint - determined by size of seed, fineness and length of fibers.
3. Earliness - closely related to uniformity and maturity, generally less disease and insect damage in early maturing varieties, stronger fibers.
4. Size and kind of boll - related to picking quality of cotton.
5. Plant type - strong stems to support foliage and heavy fruiting, minimum amount of foliage, not too large for mechanical harvesting.
6. Kind and size of leaf - small leaves result in less boll rot, smooth leaves gin cleaner.
7. Storm resistance - short plants with strong stems, bolls which do not open wide, lint which clings to burr, well-adapted to mechanical harvesting.
8. Seed size - associated with percentage lint.
9. Disease resistance
10. Insect resistance

FIBER PROPERTIES:

1. Staple - average length of fiber (long fiber is used for more expensive cotton products and short fibers for rugs and blankets).

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

2. Strength - may be affected by rainfall and other environmental conditions but is also associated with some varieties.
3. Fineness - related to staple - long fibers are usually fine.
4. Maturity - immature fibers are weak.
5. Uniformity - important to spinner.

SEED COMPONENTS

1. Linters
2. Oil
3. Protein
4. Hulls

Cotton Varieties for Texas

LOWER RIO GRANDE PLAIN:

1. Stoneville 7
2. Deltapine Smooth Leaf
3. Hale Deltapine 33
4. Deltapine TPSA
5. Rex
6. Delfos 9169
7. Stardel
8. Coker 124
9. Tideland, TPSA No. 1
10. Coker 100A (WR)
11. Wescot
12. Lankart Sel. 611
13. Lankart Sel. 57
14. Stormking, TPSA No. 1
15. D & PL - Fox 4
16. Northern Star 11

COASTAL PRAIRIE AND UPPER RIO GRANDE PLAIN:

1. Austin
2. Stoneville 3202
3. Stoneville 7
4. Empire WR

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

5. Lankart Sel. 57
6. Dixie King
7. Northern Star 11
8. Brazos
9. D & PL - Fox 4
10. Delfos 9169
11. Coker 124
12. Deltapine TPSA
13. Deltapine 15
14. Deltapine Smooth Leaf
15. Acala 1517C
16. Malone's Rowden
17. Floyd 8G

BRAZOS RIVER VALLEY:

1. Stoneville 7
2. Deltapine 15
3. Deltapine Smooth Leaf
4. D & PL - Fox 4
5. Stoneville 3202
6. Deltapine TPSA
7. Delfos 9169
8. Brazos
9. Lankart Sel. 57
10. Northern Star 11
11. Empire WR
12. Acala 157C
13. Malone's Rowden
14. Floyd 8G

BLACKLAND PRAIRIES AND ROLLING PLAINS:

1. Gregg
2. Lankart Sel. 57
3. Paymaster 54B
4. Northern Star 11
5. Blightmaster
6. Empire WR
7. Lockett 88
8. Western Stormproof

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

9. Deltapine TPSA
10. Acala 1517 BR-1

HIGH PLAINS:

1. Rex
2. Austin
3. Gregg
4. Empire WR
5. Lankart Sel. 57
6. Paymaster 101
7. Paymaster 54B
8. Western Stormproof
9. Lockett 88
10. Blightmaster
11. Northern Star 11
12. Acala 1517 C
13. Brazos
14. Dunn 24BR
15. Deltapine TPSA
16. Acala 1517 BR-1

TRANS-PECOS:

1. Acala 1517D
2. Acala 1517C
3. Acala 1517 BR-1
4. Wescot
5. Empire WR
6. Deltapine TPSA
7. Northern Star 11
8. Mesilla Valley Acala
9. Earlistaple
10. Del Cerro 876 Acala
11. Lankart Sel. 57
12. Mesa Acala Improved
13. Malone's Rowden
14. Floyd 8G

Fertilizer and Water Requirements

FERTILIZERS:

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

70 # nitrogen are removed from the soil for each 500 # lint produced.

1000 # lint, 2000 # seed, and 4000 # stalk, etc. will remove 29.4 # phosphorus per acre per year.

Generally no response to potassium fertilizers.

WATER:

For normal cotton production, 24-36 inches of water per year are required. This will depend upon the type soil and summer temperatures. Sandy soils require more water than clay soils. High summer temperatures also increase water requirements.

Planting

Many factors influence the germination of seed and the stand obtained by plants. Some of these are soil moisture, temperature, viability of seed, firmness of the soil, type of seed (fuzzy or delinted), and treatment of seed to control soil-borne diseases. Other factors directly related to the planting operation also affect the emergence of cotton seedlings. Among these are the rate of seeding, depth of covering, type of furrow openers, and methods used to firm the soil to prevent loss of moisture.

DATE

The young cotton plant is tender and will not withstand freezing temperatures. For this reason, cotton usually is planted after the average date of the last killing frost in the spring. Planting dates in Texas range from February in the Lower Rio Grande Valley to May 15 to June 20 at Lubbock on the High Plains. The date of planting is more critical at the northern edge of the cotton belt in Texas, because the frost-free period is barely sufficient to mature a reasonably good crop of cotton. Farther south a longer growing season prevails.

Recent experiments at Lubbock have shown that 30 percent or more of the cottonseed usually emerges when the minimum soil temperature averages 60° F. 8 inches deep in the seedbed for 10 days. This average temperature is not reached until May 1 at Lubbock. Here the highest percentage of

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

of emergence usually occurs between May 10 and 25. Planting after June 1 shortens an already short growing season and lowers yields. The latest practical planting date at Lubbock is June 15 to 20.

Slow germination and cold soils go together. There is more danger of the seed rotting and the seedlings are more susceptible to disease in cold soils.

SEED TREATMENT

Properly treating seed with an approved fungicide is one measure used to help reduce losses in stand caused by seedling disease. Seed treatment also helps prevent seed decay and damping-off from both soil and seed-borne organisms before germination. Such protection can be obtained after germination occurs by mixing suitable fungicides with the covering soil.

METHOD

Cotton is planted on beds (ridges) and in shallow listed furrows. In the more humid areas, where heavy rains are likely to occur during the planting season, cotton is usually planted on beds. This allows drainage away from the beds and the surface of the beds dries out more rapidly. In areas having an average yearly rainfall of 25 inches or less, cotton is planted in lister furrows to place the seed in moist soil. The sides of the furrows also protect the young cotton seedlings from blowing sand.

The lister planter equipped with suitable attachments is the most common type of planter used for planting cotton in Texas. The planter may be equipped with different types of openers, covering equipment and press wheels to suit the particular conditions.

PLANT POPULATION

The rate of seeding should be based on the final desired plant population and the average percentage of emergence expected. Experiments in Texas and Oklahoma have shown that yield of cotton and mechanical picking efficiency are not affected significantly with populations of 25,000 to 60,000 plants per acre, which is approximately 2 to 4 plants per foot of row. Populations of 40,000 to 60,000 plants per acre have been found to be optimum for mechanical stripper harvesting. For non-delinted seed this ranges from 22-42 pounds per acre. The average is 33 pounds per acre. The amount of mechanically delinted seed will be 1,275

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

pounds per acre. Eight to ten pounds of acid delinted seed are used per acre.

No significant variations in the yield of cotton have been obtained from different methods of obtaining stands on alluvial soil near College Station. Stands were obtained by hill-dropping, drilling to a stand, hand chopping, and by several types of mechanical choppers. The saving in seed and labor for chopping, by hill-dropping or drilling to a stand, amounted to $6 to $8 per acre.

DEPTH TO COVER SEED

The seed should be covered at the minimum depth at which they will remain in moist soil until they sprout and emerge. Shallow depths of 1 to 2 inches are suitable for the more humid areas of Texas, and depths of 3 to 4 inches are necessary in the drier parts of the State. Tests have shown, however, that a depth of 1 to 2 inches is more satisfactory in the drier areas if the seeds are pressed into firm, moist soil before covering.

FURROW OPENERS

Two general types of furrow openers are used in planting cotton: the chisel type and the curved runner. The chisel-type opener is used extensively on lister-type planters for planting on beds on the High Plains and in other areas. The chisels vary in width from 3/4 to 2 inches. The narrow type with long, low dirt shields is more desirable because the seeds are confined to a narrow drill, and the shields prevent loose soil from falling below the seed.

A modification of the standard runner-type opener has a narrow opening and dirt shields which extend to the rear and prevent loose soil from falling in the furrow ahead of the seed. This modification has given faster emergence and better stands of cotton than the standard curved opener in experiments conducted at College Station and in West Texas.

PRESS WHEELS

Press wheels are used in planting cotton in some areas to provide a firm contact between the seed and the soil, thus permitting the seed to absorb moisture from the soil more rapidly. Types used are the surface-press and the seed-press wheel. The surface-press wheel is used on the surface of the soil after the seeds have been covered. The seed-press wheel is used in the seed furrow immediately behind the furrow opener to press the seed into firm, moist soil.

Surface-press wheels are used extensively in East and Central Texas. A common

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued

practice is to delay the pressing operation for several hours until the surface of the freshly planted soil has dried enough to prevent it sticking to the press wheel. A solid press wheel is then used over the drill row. To eliminate this extra operation, efforts have been made to develop a type of press wheel to which soil would not adhere enough to prevent satisfactory operation. A rubber-flap press wheel was developed which has given good results and works satisfactorily on sticky clay soils. Surface-press wheels are not recommended in the subhumid areas of West Texas because they tend to create a hard, compact layer over the seed, which interferes with emergence. A seed-press wheel with a soft zero-pressure rubber tire was developed at the Lubbock Experiment Station. This spring-loaded press wheel presses the seed into firm, moist soil in a narrow furrow opened by a chisel-type opener. A drag-type covering device covers the seed with 1 1/2 to 2 inches of loose soil. This press wheel and covering device have given faster emergence and better stands than the conventional methods used in that area.

Cultivation

The main purpose of cultivation is to destroy weeds, which compete with crops for moisture and plant nutrients. Cultivation loosens the soil, permits better aeration and penetration of water into the soil, promotes decomposition of soil organic matter and, consequently, increases crop yields. Weeds have been controlled in cotton by the use of various kinds of cultivating implements, especially the ordinary cultivator equipped with suitable sweeps, harrows, and the common hand hoe. The rotary hoe was developed and has come into general use in Texas.

Cultivation practices for cotton vary considerably in different parts of Texas. The kind of cultivation depends to some extent on whether planting was done on beds or in lister furrows. The frequency of cultivation is determined largely by rainfall, with a cultivation after each rain until the cotton plants are large enough to suppress weed growth. Where cotton is planted on beds, the first and succeeding cultivations are usually made with sweeps. These cultivations are shallow, 2 to 3 inches deep. Weeds are uprooted and destroyed in the middle and cover small weeds in the drill row. Sometimes, however, the first cultivation may be made with the rotary hoe.

Where cotton is planted in lister furrows, as on the Rolling and High Plains, the first cultivation may be made with the sled cultivator or the rotary hoe. Later cultivations are generally made with sweeps. The low rainfall and prolonged dry periods on the Rolling and High Plains minimize the weed problem in these areas.

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

Experiments in Texas have shown that a minimum amount of cultivation sufficient to keep down weeds is the most efficient. At the Spur Experiment Station, on the Rolling Plains where moisture is usually a critical factor, two cultivations during the growing season produced the highest average yield of cotton over a period of 12 years. At College Station, with an average yearly rainfall of about 38 inches, three to five cultivations with sweeps made the highest yield of cotton for 6 years.

Prompted by serious labor shortages during and following World War II, coupled with the increasing necessity to reduce production costs, the amount of mechanical harvesting of cotton has increased rapidly. Accompanying this rapid conversion to mechanization has been the necessity for using preharvest defoliating and drying chemicals as an essential part of a successful harvesting operation before frost. In some Texas areas, the use of preharvest chemicals is considered beneficial to hand harvesting and necessary adjunct to production practices.

REASONS FOR USING

There are several reasons for defoliating and desiccating cotton. Defoliation aids in harvesting, whether by hand-pulling or by machine, resulting in higher grades because the source of trash and lint staining is removed. Defoliation aids in the control of insects and is part of the recommended pink bollworm control program. And, most important, defoliation, in connection with machine-harvesting, greatly reduces the cost of harvesting. Experiments over several years have shown that desiccation combined with machine-stripping saved $10 to $29 per bale over hand-pulling on the Blackland Prairies. Defoliation plus machine picking resulted in a saving of $10 to $15 per bale over hand-pulling in South Texas. Yield per acre is the most important factor in determining the harvesting cost per bale.

TYPES

Most of the defoliants and desiccants now used are essentially contact herbicides. At certain recommended rates, they cause defoliation, but at higher rates they dry the leaves, stalks, and bolls rapidly, with little or no true leaf drop. Other chemical types cause only rapid killing and drying, with slight or no defoliation even at low rates. Defoliating and desiccating chemicals may be divided roughly into three arbitrary groups: the true defoliants, which mainly cause leaf fall with minimal drying; the defoliant-desiccants, where the results depend largely on the rate; and the true desiccants, which mainly induce rapid killing and drying with the least leaf drop.

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

The commercial chemicals used change from year to year with the development of new compounds and the discarding of the ones less effective or more costly. These are marketed as dusts, water-soluble sprays and concentrates, emulsifiable sprays, and oil-soluble materials. The chemical names, trade names, rate range per acre, and dilution data are supplied on the manufacturer's label in the official Cotton Pest Control Guide, published yearly by the National Cotton Council. Specific recommendations for the individual states are distributed by various state agencies. The Texas Agricultural Extension Service annually revises and distributes the official "Cotton Defoliation Guide for Texas." In addition, an annual progress report on the research conducted and the results obtained with commercial as well as new, experimental, preharvest chemicals in various locations in Texas is published by the Texas Agricultural Experiment Station.

CHEMICALS TO USE

A number of factors determine the proper preharvest chemical to use. The ideal chemical should be reasonably safe to handle and apply, have minimum corrosive action on distribution equipment, should not contaminate or reduce the yield or quality of the fiber or seed, and the compound or the residues should be relatively non-toxic. The compounds must have properties which permit their use in relatively low amounts and be low in initial cost and unit application. In most cases, the cost of the chemical plus application should not exceed $5.00 per acre. Airplane applications which require rates in excess of 40 pounds of dust or 10 gallons of liquid spray per acre are not economically feasible. The tendency of the compounds to drift to susceptible crops and their ability to suppress regrowth and to kill, defoliate, or desiccate weeds and grasses associated with the crop are other important considerations. The growing conditions, type of cotton grown, and method of harvesting also have bearing on the selection of the preharvest chemical. Usually, in high-producing, irrigated, open-boll cotton, true defoliants are preferred. The crop is set over a longer time and is harvested by hand, spindle-type pickers, or by a combination of the two. For this type of cotton, desiccants are seldom used because of their drastic action, undesirable dry-leaf trash, and other reasons. Examples of true defoliants in wide use are the cyanamid and sodium chlorate-sodium borate dusts, magnesium chlorate, sodium chlorate-sodium borate, Endothal, amino triazole, and thiophosphate sprays.

For the smaller storm-resistant, lower producing-dryland-grown cottons, or for crops to be stripped mechanically, the desiccants have proved more satisfactory. The chlorinated phenols, arsenicals, and others, singly or fortified with various additives, are examples of the true desiccants.

REGROWTH PROBLEM

Regrowth, particularly during a wet harvest season or under conditions of high soil moisture, often defeats the practical purpose of defoliation and desiccation. Timing of the application is important in controlling regrowth. Rapid regrowth usually necessitates a second chemical application. The ideal solution to the problem would be to apply a chemical that would not interfere with defoliation or desiccation but would prevent or retard regrowth. Amino triazole, a true defoliant is also effective in inhibiting regrowth under most conditions. Herbicides such as 2, 4-D and similar ones have been added to desiccants to suppress regrowth. Contamination of application equipment and carry-over into planting seed raise serious problems when this is practiced. Several experimental compounds, compatible with defoliants and desiccants, show promise in controlling regrowth.

WHEN TO APPLY

Mature, well-fruited, active plants defoliate best. Premature application of defoliants or desiccants can damage grade and cause losses in yield and quality since boll development stops with the chemical application. If the youngest bolls are at least 30 days old, are firm when pressure is applied, or cannot be sliced easily with a sharp knife, their fibers or seeds will not usually be damaged by the application of preharvest chemicals. Other ways of timing the application are to delay defoliant applications until about 50 percent of the bolls have opened or delay the application of desiccants until 60 to 70 percent or more of the bolls are open. At this time, with proper cultivation practices, the plants should be in cut-out but still be active. The condition of the plants at the time of chemical application is the key to effective results, rather than some specific date on the calendar.

Weather conditions at the time of application are important; forecasts for the area should be studied carefully before application. Day temperatures below 70^{o} F. or night temperatures below 55^{o} F. are not favorable for good results. The rate of leaf drop or desiccation slows drastically, and even the better chemicals are ineffective during periods of low temperature. Moderate to high humidity contributes to a leaf condition more reactive to chemicals; dusts require dew or high humidity for optimum results. High winds hinder proper distribution of chemicals and promote drift to adjacent crops and sensitive plants.

UNIT: Major Crops
TOPIC: Cotton
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The grower should defoliate or desiccate just enough acreage to stay ahead of the harvesting operation. Applications are recommended 8 to 14 days prior to the intended harvesting date in South and Central Texas and 2 to 3 weeks before harvest in North and Northwest Texas.

BOTTOM DEFOLIATION

Under conditions of high humidity and rainfall, or in irrigated cotton, the practice of bottom defoliation has proved to be advantageous. In rank cotton with a heavy canopy of foliage, damp conditions near the base of the plant delay boll opening and favor boll rots. Removal of the lower leaves, with the spray pattern directed only towards the mature lower bolls (probably never more than one-third up on the stalk), permits the drying action of wind and sun and greatly reduces loss from boll rot. If the defoliant is sprayed properly, the bottom crop can usually be harvested by hand without injuring the immature crop at the top. Bottom defoliation can be followed by total defoliation following maturity of the upper bolls. A high clearance sprayer, properly shielded, works well for this practice.

APPLICATION EQUIPMENT

Both airplane and ground sprayers can be used successfully for applying preharvest chemicals. In general, conventional equipment and methods of applying insecticidal and fungicidal sprays and dusts are applicable, with slight modifications, to preharvest chemicals. Thorough coverage of the plants is extremely important. Large droplets are essential for good defoliation. Well-shielded, high-clearance sprayers with sufficient nozzles to insure adequate plant coverage are recommended for ground application. Other sprayers work well in small cotton.

Cotton Diseases

Cotton has its share of diseases. Some kill the cotton plant while others only lower its production efficiency. The Disease Loss Committee of the Cotton Disease Council estimated for the 5-year period, 1953-57, that for every 100 bales ginned there should have been 110 bales if these losses due to disease had not occurred. Diseases also reduce the market value of the harvested cotton by causing lower grades, spot grades, and the production of immature fibers.

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

The major diseases which contribute to losses in Texas are Fusarium wilt, Verticillium wilt, root rot, seedling disease, nematodes, bacterial blight, boll rots, and fungus leaf spots.

FUSARIUM WILT

Fusarium wilt occurs throughout the world on all kinds of soil, from sandy acid to neutral soils. In Texas, it occurs largely in the upland soils of East Texas but is also found in the near neutral soils of Brazoria and Fort Bend counties in Southeast Texas and in Martin, Hardeman,and Wilbarger counties in West and Northwest Texas.

This disease is caused by a soil-inhabiting fungus. The fungus invades the plant through the roots where it enters the vascular ducts. It grows through the vascular tissues and can be found in all above-ground plant parts, including bolls and seed. The fungus causes plugging of the water-conducting vascular system, which leads to wilting and death of the plant.

The fungus can attack the plant at any growth stage. Disease symptoms in seedlings and young plants are yellowing and browning of cotyledons and leaves. Older plants may be stunted, followed by wilting, leaf yellowing,and leaf drop. Leaves first become yellow along the margin and then the yellowing progresses toward the midrib. The yellow tissues soon die and turn brown. As affected areas enlarge, the petiole abscission layer forms and the leaves are shed. On cutting crosswise through a stem or branch of a wilt plant, one can see a dark brown discoloration of the woody tissue.

Fusarium wilt is often associated with nematodes. These microscopic, soil-inhabiting worms puncture the roots of the cotton plant, making it easier for the wilt fungus to enter the root. In most cases, severe outbreaks of the disease are due to the combined effects of nematodes and the fungus. For this reason, the disease is more properly referred to as the Fusarium wilt-nematode complex.

The wilt fungus is usually introduced to a field by planting cottonseed which carry it internally. It is spread to all parts of the field by spore dissemination and movement of debris from infected plants. Once established, it can survive on organic matter in the soil for many years.

The most economical control of the Fusarium wilt-nematode complex is obtained by growing resistant varieties. In fields where the disease is very severe, varieties, such as Auburn 56 and Plains, which are highly resistant to wilt and nematodes, should be grown. Where the disease is not as severe, varieties such as Austin, Tex, Empire WR, and Coker 100 will give adequate control. Long-term cropping systems and the use of balanced fertilization will help reduce losses.

VERTICILLIUM WILT

In the United States, Verticillium wilt occurs across the entire Cotton Belt. In Texas, it occurs extensively in the irrigated areas of the High Plains, Rolling Plains, and the southwestern irrigated valleys. This disease has been present in isolated fields in Ellis and Hunt counties for a number of years. In recent years, it has spread from the western areas eastward to a line from Hardeman, Wilbarger, Baylor, and Howard counties.

Verticillium wilt accounts for 8.87 percent of the total yield loss in Texas. Losses also occur in the form of lower and spot grades and the production of immature fibers.

Verticillium wilt is caused by a soil-borne fungus. The fungus invades the roots and grows throughout the plant in the vascular system. This leads to wilting and shedding of the leaves.

The plant may be attacked at any stage of growth. Young plants may become stunted and the leaves turn yellow between the main veins. These tissues die, turn brown and the leaves are shed from the plant. On cutting stalks of Verticillium wilt plants, one will observe the same type vascular discoloration as found in Fusarium wilt plants.

For positive differentiation between Fusarium and Verticillium wilt, it is necessary to isolate and identify the fungus. In Texas, most wilts west of a line from Dallas to San Antonio will be Verticillium, and those occurring east of that line will be Fusarium. In cases where the two wilts occur in the same area and in the same field, as in Hardeman, Wilbarger, and Martin counties, Fusarium wilt will usually be associated with nematode injury while Verticillium wilt will not.

Verticillium wilt is generally most severe in irrigated, heavy, fertile soils with good organic matter content, and disease development is usually aided by good agronomic practices. The fungus is active only when the soil temperature is below 85° F. Wilt symptoms are usually observed early in the

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

growing season or toward the end. Irrigation water often lowers the soil temperature; therefore, Verticillium wilt is generally most severe in irrigated fields.

Verticillium wilt is spread by the movement of debris from infected plants within fields and from field to field. Gin trash and the movement of soil by cultivation can spread the disease.

Verticillium wilt is best controlled by growing resistant or tolerant varieties. The long staple Pima type varieties are resistant, but most of the short, staple upland varieties are susceptible. Such varieties as Auburn 56, Coker 100 WR, Empire WR, Rex, and Austin have some tolerance. Highly tolerant and resistant varieties are being developed.

Planting on high cantaloupe-type beds, which have a higher soil temperature in the root zone, helps to reduce losses. Thickly spaced plants of about 4 to 6 per foot of row also will reduce yield losses.

COTTON ROOT ROT

Cotton root rot is limited to cotton production areas of the United States and Northern Mexico. In the United States, it occurs mainly in the alkaline soils of Texas and other Southwestern States. The disease is severe some years on the Blackland and Grand Prairies. Root rot accounts for 25.53 percent of the total cotton disease yield loss in Texas. Losses also occur in the harvested crop in the form of lower and spot fiber grades and the production of immature fibers.

The fungus which causes root rot attacks about 2,000 plant species other than cotton and is found in cultivated and uncultivated soils. The fungus invades the roots of the plant by breaking down the outer cells. It penetrates the root where it destroys the vascular tissues and kills the plant within a short time. The disease is most severe during seasons of high soil temperature and moisture.

The first symptoms of the disease often occur about 7 weeks after planting, but is generally most severe during the period of flowering and boll maturity. The first symptoms are slight yellowing or bronzing of the leaves. These leaves will have a higher temperature than healthy ones, and this can be determined simply by feeling the leaves. This followed by wilting of the leaves, then

UNIT: Major Crops
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(Information Sheet continued)

drying and browning follow rapidly. Leaves are seldom shed from the plant. The outstanding root symptom may be seen by peeling the bark from the main stem down to the root area. The above-ground portion of the hard wood will have the normal cream color, while at the soil line zone this will change to a reddish-brown color.

Three facts are used in obtaining practical control of cotton root rot: (1) the fungus, both the mycelial and sclerotial stages, is easily killed by drying; (2) the mycelium and sclerotia can be eliminated from soils by microbial activity; and (3) the disease tends to be less severe in soils with an adequate nitrogen level.

Drying of the soil can be obtained by flat-breaking a field in the early fall 6 to 10 inches deep with a moldboard or good disc plow. If the broken soil is left alone and no rain occurs, in 2 weeks the slices will have dried enough so that most of the fungus bodies are killed. High microbial activity can be obtained by burying green organic matter from such crops as Huban sweet clover, Austrian Winter peas and the green stubble from grain sorghum production. The green organic matter should be shredded and then buried 6 to 8 inches deep. This is done best by a plow with an action that inverts the plow slice so that the organic matter goes to the bottom of the furrow. When preparing the seedbed, it is best to run the bedders so that the layer of organic matter is not disturbed. A favorable nitrogen level in the soil can be maintained by proper fertilization.

If any of the foregoing principles are to be used singly, the best one is early-fall flat breaking with a moldboard plow to dry the upper soil area. It has been demonstrated that a combination of these three principles will reduce losses of 40 to 80 percent to as low as 5 to 10 percent.

SEEDLING DISEASE

Seedling disease occurs wherever cotton is grown. In Texas, it accounts for 22.73 percent of the total yield loss. Seedling disease is caused by several fungi which live in the soil. These fungi attack young seedlings from the time of germination until true leaves begin to appear. The seedlings may be killed or the roots may be only girdled with the seedlings remaining alive. Such seedlings produce stunted plants with poor root systems which limit their productive ability.

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The first symptom of the disease is wilting of young seedlings. The destroyed portion of the stem is marked by brownish lesions (sore shin) which occur in the area near the soil surface. The tap root and rootlets may have brown to blackish lesions where the fungi destroyed root tissue. Seedlings which are attacked, but not killed, tend to be shorter than healthy ones. Plants from seedlings that are damaged may grow slower and tend to be shorter than those with undamaged roots. Plants which survive but have badly damaged roots will wilt suddenly and die about the time of flowering. Seedling disease is most severe when periods of cool, wet weather follow planting. It tends to be more severe in the heavier soils and in soils with a high level of organic matter.

A number of practices will help reduce seedling disease. It is important that residue be prepared in such a way that excessive amounts of the old crop residue will not be in the seed placement area. Good planting methods which allow the young seedlings to emerge and grow off rapidly also are important. Whenever possible, cotton should be planted on beds so that drainage and drying will occur after rains.

Germination of cottonseed and the growth of cotton seedlings are slow at soil temperatures much below 70° F. Slow-growing seedlings remain susceptible for longer periods; thus they are more apt to be attacked and killed by the seedling disease fungi. For this reason, planting should not be done when the soil temperature is or apt to be below 70°F. for any length of time.

Mixing fungicides into the covering soil at planting also is recommended for seedling disease control. Fungicides recommended by the Texas Agricultural Experiment Station should be used and may be applied effectively as a spray or a dust.

NEMATODES

Nematode injury to plants occurs over the entire world. In Texas, it causes 4.09 percent of the total cotton disease loss. The root-knot nematode is the most damaging that attacks cotton roots. Others that attack cotton to a lesser extent are the root lesion and the sting nematode.

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TOPIC: Cotton
(Information Sheet continued)

Nematodes enter the roots at or near the growing point. Root tissues are affected by the root-knot nematode from knots or galls. Nematode injury generally is more severe in sandy soils.

Roots of the cotton plant can be invaded by nematodes at any growth stage. They can attack young seedlings, causing them to die. Nematodes damage the roots and make them readily accessible to the Fusarium wilt fungus either by mechanical wounding or predisposition. Thus, nematodes are the principal cause of severe outbreaks of Fusarium wilt.

Affected plants appear unthrifty and yellow in color. They may be stunted and appear as plants with a severe water deficiency. Severely affected plants eventually die.

Losses caused by nematodes are best reduced by growing resistant varieties of cotton. Rotation with nonsusceptible crops is also a valuable practice. Soil fumigation with nematocides would probably be profitable if the affected areas are large.

BACTERIAL BLIGHT

Bacterial blight may occur wherever cotton is grown. In Texas, it is generally most severe on the High Plains, Coastal Prairie, irrigated valleys of the Trans-Pecos area, and in the sprinkler-irrigated areas on the Rolling Plains. It causes 25.82 percent of the total cotton disease yield loss in Texas. Additional losses occur in the form of lower and spot grades of the harvested fiber.

This disease is caused by a bacterium. The organism enters the plant through open stomata in the leaves, bolls or stems, or through wounds in the tissues. The bacteria break down the cell wall of the spongy tissues, releasing the cellular juices. For this reason, young lesions will have a water-soaked appearance.

The blight organism may overwinter in the soil on undecomposed plant debris, but is more commonly carried from plant to plant and from older tissues to new tissues by wind-driven, splashing rains. New symptoms of the disease will usually appear 7 to 14 days following a shower. Sprinkler irrigation is an excellent spreader of bacterial blight. Since the stomata must be open for the bacteria to enter the plant, extensive spreading occurs

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

primarily during daylight hours. However, night showers, accompanied by blowing sand, can spread bacteria also. The disease may be disseminated from field to field by whirlwinds which pick up diseased leaves. Splashing water can then carry the bacteria from the dead leaves to cotton plants.

The only known practical control of bacteria blight is the growing of resistant varieties. Resistant varieties, such as Acala 1517 BR, Acala 1517 BR-1, Blightmaster, Austin, Rex, and Mebane B-1, are available for commercial production. Many new varieties are being developed. Planting known disease-free seed will give control if there is no soil carry-over. Acid-delinted seed which have been treated adequately with a seed-protectant fungicide will reduce early season infection but will not necessarily prevent later epidemics.

BOLL ROTS

Boll rots cause 1.17 percent of the total cotton disease yield loss in Texas, due to bolls rotting before maturity. This rot also causes lower grades of the harvested crop to be produced.

Boll rots are caused by a number of fungi which are not real pathogens. They invade the bolls mainly through wounds. However, when the humidity is high, they may become primary pathogens on unopened bolls which are approaching maturity. Bacterial blight lesions provide the principal ports of entry for these boll-rotting fungi.

Boll rots are more severe where cotton grows tall and rank. For this reason, practices which prevent excessive vegetative growth will reduce the rot. Bottom defoliation permits rapid drying of the lower areas of the plants after heavy dews and rains and is effective in reducing boll rots. Losses may also be greatly reduced by the control of boll-damaging insects and the growing of varieties which are resistant to bacterial blight.

Some of the loss in cotton production in Texas is due to fungus leaf blights each year which cause excessive shedding of infected cotyledons and leaves during wet springs and falls. These leaf-spot diseases are best controlled by proper seed treatments and crop rotations. Fine shredding and turning under of crop residues promotes complete decomposition during the winter and will also control these diseases.

UNIT: Major Crops
TOPIC: Cotton
(Information Sheet continued)

True cotton rust occurs in Texas along the Mexican border from Brownsville to El Paso. True rust spots on the leaves are orange in color. The fungus bodies which infect cotton are produced on several species of grasses, primarily the gramas. The disease is most severe in the spring when growth of these grasses is good and when frequent showers are occurring. Under these conditions, an abundance of inoculum is produced on the grasses and is spread to cotton by rain. The disease is best controlled by eradicating the host grasses.

MAKING INSECT COUNT

There are two methods that may be used to check a field for bollworm population.

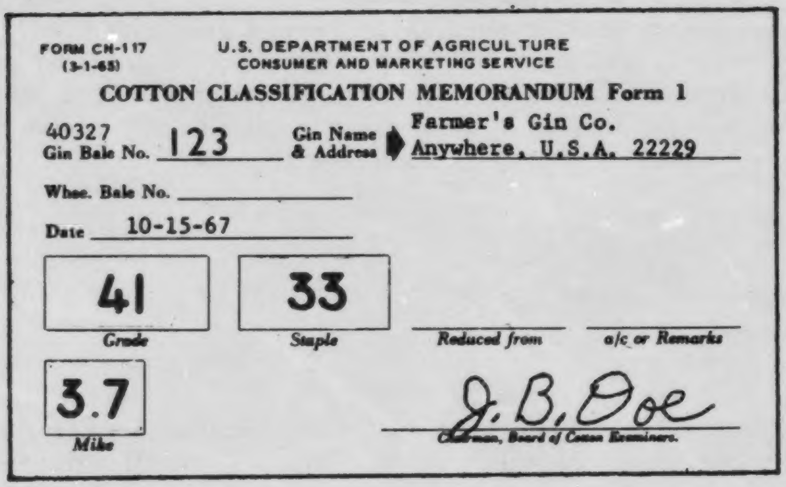
Method No. 1 - Examine the terminal buds of 100 cotton plants and 100 consecutive squares and bolls at each of several points in the field. Begin treatment when bollworm eggs and four or five young worms are found per 100 terminals or 5% of the squares and small bolls have been injured by small bollworms.

Method No. 2 - Make a whole plant examination (terminals, squares, flowers, or bolls) of all plants on 10 feet of row in at least five locations in the field. When larval counts average more than 1.5 larvae per 10 feet of row or exceed 7 larvae in 50 feet of row, begin treatment.

FORM CN-26
(4-1-67)

UNITED STATES DEPARTMENT OF AGRICULTURE
CONSUMER AND MARKETING SERVICE
COTTON DIVISION
WASHINGTON, D.C. 20250

THE CLASSIFICATION OF COTTON



FORM CN-117
(3-1-65)

U.S. DEPARTMENT OF AGRICULTURE
CONSUMER AND MARKETING SERVICE

COTTON CLASSIFICATION MEMORANDUM Form 1

40327
Gin Bale No. 123
Gin Name & Address: Farmer's Gin Co.
Anywhere, U.S.A. 22229

Whse. Bale No. ____

Date 10-15-67

Grade: 41
Staple: 33
Reduced from: ____
a/c or Remarks: ____
Mike: 3.7

J. B. Doe
Chairman, Board of Cotton Examiners.

In the above illustration the code 41 in the "Grade" box means that the sample was Strict Low Middling in grade. The code 33 in the "Staple" box means that the staple was 1-1/32 inches in length. The figure 3.7 in the "Mike" box is the micronaire reading of the sample.

GRADE NAMES, CODES, AND EQUIVALENT SYMBOLS

GRADE NAME	PLUS	WHITE	LIGHT SPOTTED	SPOTTED	TINGED	YELLOW STAINED	LIGHT GRAY	GRAY
Strict Good Middling		(01) SGM						
Good Middling		(11) GM	(12) GM Lt Sp	(13) GM Sp	(14) GM Tg	(15) GM YS	(16) GM Lt Gray	(17) GM Gray
Strict Middling		(21) SM	(22) SM Lt Sp	(23) SM Sp	(24) SM Tg	(25) SM YS	(26) SM Lt Gray	(27) SM Gray
Middling Plus	(30) M Plus							
Middling		(31) M	(32) Mid Lt Sp	(33) Mid Sp	(34) Mid Tg	(35) Mid YS	(36) Mid Lt Gray	(37) Mid Gray
Strict Low Middling Plus	(40) SLM Plus							
Strict Low Middling		(41) SLM	(42) SLM Lt Sp	(43) SLM Sp	(44) SLM Tg		(46) SLM Lt Gray	(47) SLM Gray
Low Middling Plus	(50) LM Plus							
Low Middling		(51) LM	(52) LM Lt Sp	(53) LM Sp	(54) LM Tg			
Strict Good Ordinary Plus	(60) SGO Plus							
Strict Good Ordinary		(61) SGO						
Good Ordinary Plus	(70) GO Plus							
Good Ordinary		(71) GO						
Below Grade		(81) BG Below GO	(82) BG Below LM Lt Sp	(83) BG Below LM Sp	(84) BG Below LM Tg	(85) BG Below Mid YS		(87) BG Below SLM Gray

STAPLE CODES AND EQUIVALENT LENGTHS

CODE	LENGTH	CODE	LENGTH	CODE	LENGTH
24	Below 13/16	31	31/32	36	1-1/8
26	13/16	32	1 inch	37	1-5/32
28	7/8	33	1-1/32	38	1-3/16
29	29/32	34	1-1/16	39	1-7/32
30	15/16	35	1-3/32	40	1-1/4

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Corn

OBJECTIVE: To develop an understanding of the economic importance of corn as a major crop in Texas.

REFERENCES:

Required:

1. Plant Science, Janick and others, pp. 264-265, 424-429.
2. Crop Production, Delorit and Ahlgren, Ch. 3, pp. 77-137.
3. Information Sheet, "Grades of Corn".

QUESTIONS OR ACTIVITIES:

1. Give a brief history of corn as a crop.
2. What is corn used for?
3. What are the natural hazards to corn production?
4. Name the 6 groups of corn varieties.
5. What factors should be considered in selecting a hybrid strain of corn?
6. How are nutrient needs of corn determined?
7. How does corn respond to fertilizing?
8. When should corn be planted?
9. What determines planting rate for corn?
10. What equipment is used for planting corn?
11. Why cultivate corn?
12. What equipment is used to cultivate corn?
13. What are the moisture requirements for corn?
14. How is corn harvested?
15. At what stage of maturity should corn be harvested?
16. What are the major diseases attacking corn?
17. What are the major insects attacking corn?
18. What are the USDA grades for corn?
19. What factors determine grade?

Information Sheet
on
GRADES OF CORN

Grades, Grade Requirements, and Grade Designations

The following grades, grade requirements, and grade designations are applicable under these standards:

Corn

(a) Grades and grade requirements for the classes Yellow Corn, White Corn, and Mixed Corn.

Grade	Minimum test weight per bushel	Maximum limits of --			
		Moisture	Broken corn and foreign material	Damaged kernels	
				Total	Heat-damaged kernels
	Pounds	Percent	Percent	Percent	Percent
1.........	56	14.0	2.0	3.0	0.1
2.........	54	15.5	3.0	5.0	0.2
3.........	52	17.5	4.0	7.0	0.5
4.........	49	20.0	5.0	10.0	1.0
5.........	46	23.0	7.0	15.0	3.0
Sample grade...	Sample grade shall be corn which does not meet the requirements for any of the grades from No. 1 to No. 5, inclusive; or which contains stones; or which is musty, or sour, or heating; or which has any commercially objectionable foreign odor; or which is otherwise of distinctly low quality.				

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Forage and Hay Crops

OBJECTIVE: To develop an understanding of the economic importance of forage and hay crops as major crops of Texas.

REFERENCES:

Required:

1. Plant Science, Janick and others, pp. 443-453.
2. Crop Production, Delroit and Ahlgren, Index pp. 735-744.
3. "Insects Attacking Forage Crops", Randolph and Garner, Texas Agricultural Extension Service, B-975.
4. "Texas Guide for Controlling Insects and Mites on Grain and Forage Crops", Thomas and others, Texas Agricultural Extension Service, MP-339.

QUESTIONS OR ACTIVITIES:

1. What are some of the major forage and hay crops?
2. Give a brief history of forage sorghums and grass sorghums.
3. Give a brief history of Bermuda grass as a crop.
4. What are forage sorghums, grass sorghums, and Bermuda grass used for?
5. What are the natural hazards to the production of forage and hay crops?
6. What factors are considered when selecting a variety of forage sorghum or grass sorghum.
7. What factors should be considered in selecting a variety of Bermuda grass?
8. What are the major varieties of our different forage and hay crops?
9. When should sorghums be fertilized?
10. Bermuda grass responds most favorably to what fertilizers?
11. How are forage and grass sorghums planted?
12. When should forage and grass sorghums be planted?
13. What rates are used in planting forage and grass sorghums?
14. How is Bermuda grass propagated?
15. What are some requirements for successful planting of Bermuda grass sprigs?
16. What methods are used for cultivating Bermuda grass?
17. What methods are used for cultivating forage and grass sorghums?
18. What moisture requirements are necessary for growing forage and grass sorghums?
19. What methods are used in harvesting forage and hay crops?

UNIT: Major Crops
TOPIC: Forage and Hay Crops
(Assignment Sheet continued)

20. What are the major insects attacking the forage and hay crops of Texas?
21. What are 3 groups of beneficial insects for forage insects?
22. What are the major sorghum diseases?

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Grain Sorghum

OBJECTIVE: To develop an understanding of the economic importance of the value of grain sorghums as a major crop in Texas.

REFERENCES:

Required:

1. "Insects Attacking Forage Crops", Randolph and Garner, Texas Agricultural Extension Service, B-975.
2. "Texas Guide for Controlling Insects and Mites on Grain and Forage Crops", Texas Agricultural Extension Service, MR-339.
3. Information Sheet, "Grain Sorghum".
4. Plant Science, Janick and others, pp. 431-432.

QUESTIONS OR ACTIVITIES:

1. Give a brief history of grain sorghums as a crop.
2. What are the uses of grain sorghums?
3. What are natural hazards to grain sorghum production?
4. How many varieties of grain sorghums are grown in the United States?
5. How are grain sorghum varieties grouped?
6. Many of the varieties raised today are hybrids. What are some early varieties used in developing these hybrids?
7. What 13 factors should be considered in selecting a variety of grain sorghum?
8. How do grain sorghums respond to the application of fertilizers?
9. When should grain sorghums be planted?
10. What are the recommended rates for planting grain sorghums?
11. What equipment is used for planting grain sorghums?
12. What equipment is needed for cultivating grain sorghums?
13. Why is grain sorghum cultivated?
14. How much water is required to produce good yields of grain sorghums?
15. How is grain sorghum harvested?
16. When should grain sorghums harvested for grain be harvested?
17. What are the major insects attacking grain sorghums?
18. What are some beneficial insects for grain sorghums?

UNIT: Major Crops
TOPIC: Grain Sorghum
(Assignment Sheet continued)

19. What are the 4 major groups of diseases attacking grain sorghums?
20. Name 5 different groups of pathogens.
21. What should be the first step in a sorghum disease control program?
22. Name 4 grain sorghum classes.
23. Name the 7 grain sorghum grades.
24. What is dockage?
25. What is the highest moisture content grain sorghum grain can contain and be No. 1?
26. What does damaged kernels (total) include?

Information Sheet
on
GRAIN SORGHUM

Sorghum is a versatile plant. It is grown for grain or to be made into syrup for use as food for human beings, livestock, or poultry. This crop may also be used as forage and silage for livestock and for many industrial products such as the manufacture of broom heads.

Sorghum, Sorghum vulgare, Pers., is a large grass. It was so named because of its great height from the Latin word "surgo" which means "arise". More than 500 varieties and hybrids are now grown in the United States. These cross-pollinate readily and produce fertile offsprings.

The term "milo" commonly given to all sorghum grain is erroneous.

IS OLD CROP

Although sorghum was one of the earliest plants known to have been cultivated by man - in Egypt around 2000 B.C. - it was featured very little in historical trade. However, today sorghum is one of the world's most important crops.

The crop is grown in all tropical and temperate countries - in India, southern Europe, North and South America; China, where it is used as human food, and throughout Africa, especially in Egypt and the Sudan where the grain is a staple human food.

About 75 percent of the world food grain crop is eaten by humans. Sorghum ranks third among these, being exceeded only by rice and wheat. As a grain crop in the United States, its production is exceeded only by wheat and corn.

Sorghum is said to have been introduced into the United States about 1700 as food for slaves in South Carolina. Although it spread to many other states through the next century and a half, its production was not important until after the Civil War. At that time, the need arose in the new settlements west of the Mississippi River for a food, forage, and silage crop that would produce larger yields than corn did in the drier climate of the region.

Grain sorghum is now grown in most of the United States, but the principal areas of production are in the southern part of the Great Plains - Texas, Oklahoma,

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

Kansas, Nebraska, Colorado, and New Mexico, where the annual rainfall is 15 to 25 inches - and in the hot, dry, irrigated valleys of southern Arizona and California.

Though it does best in moist, fertile soil, grain sorghum's greatest importance is its high productivity in relatively poor, semi-arid, depleted areas, where it out-yields all other crops. It is more dependable than corn in producing grain under drouth conditions and can even be planted after corn has failed. With this advantage, grain sorghum helped stabilize the agriculture of West Texas and hastened the settlement of an area that previously had been used only as a range for cattle and sheep.

VALUE EQUALS CORN

Grain sorghum is considered generally to have slightly less food value than corn. It contains about 12 percent protein (3 percent more than corn) and 3 percent fat (2 percent less than corn). The carbohydrate content of both crops is about 70 percent. Like white corn, the present grain sorghum varieties and hybrids contain very little vitamin A. A yellow endosperm variety has been introduced from Nigeria and when it is bred into our present hybrids and varieties, sorghum will be available which should equal yellow corn in food value. A bushel of grain sorghum weighs 56 pounds, the same as corn, but the crop is usually sold by the hundred-weight.

Sorghum grain is used in many forms of food for humans in the United States. Currently, dextrose sugar and syrup are obtained through the processes of wet-milling and are used in canned fruits particularly. Oil extracted from the grain embryo is suitable for salad oil. A "sugary" gene, similar to the one that produces sweet corn, is available in sorghum. Pop sorghum is a desirable confection. These uses can be expanded greatly when the needs arise. As an example, during World War II, a dessert similar to tapioca in both taste and quality was manufactured from a waxy type of sorghum starch.

WAR BOOSTED USE

Sorghum grain has always been a potential source of industrial raw materials, but it was not until World War II that it was widely used for this purpose. The

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

starch content of sorghum grain (73 percent) is about the same as that of corn (63 percent) and the starch is similar to corn starch. The seedcoat of sorghum contains a wax, similar to carnauba, that is used in making furniture and shoe polishes, carbon paper, sealing wax, electrical insulation, and other products. Processing grain sorghum to make grain alcohol began during World War II. In 1945, two billion pounds of sorghum was used for this purpose, nearly half of which went into industrial alcohol.

The starch from sorghum grain can be used for food products, adhesives, and sizing for paper and fabrics. The grits obtained from the endosperm can be used in brewing just as corn grits and broken rice are used.

A wet-milling plant at Corpus Christi, with a yearly capacity of 6 million bushels of sorghum grain, manufactures starch, dextrins, dextrose, dextrose syrup, edible oil, several by-products, and two livestock feeds. Plants at Plainview, Texas, and Dodge City, Kansas, are using a dry-milling process to produce livestock feed and low protein flour which can be substituted for starch in some uses.

Sorghum has been grown in Texas since about 1857. Only those varieties suitable for forage and syrup were available at first, but grain varieties were being grown before 1900.

Through the years, all work to improve the growth and uses of sorghum has been a cooperative effort between the Texas Agricultural Experiment Station and the U.S. Department of Agriculture. This work began on the XIT ranch near Channing in 1904, and was continued at the Chillicothe substation in 1905 and the Lubbock substation in 1910. Early activities with sorghum at these stations consisted of varietal and cultural tests, introduction of varieties from abroad, selection of varieties within existing strains, and efforts to preserve the identity of varieties already in existence.

In the early part of this century, Texas sorghum stalks grew 10 to 12 feet tall. Harvesting was done with a pocket or corn knife, and the grain heads were thrown in a wagon box. During this period, the mechanical harvester arrived on the American farming scene, completely revolutionizing it - except the sorghum harvest. Stalks 10 feet high could not be combined.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

DEVELOP COMBINE VARIETIES

In order to combine grain sorghum, it was necessary to develop a variety which did not grow so tall. Plant breeders of the Texas Station and the USDA, during 1920-30, altered considerably the tall, late type. This made sorghum more easily harvested by hand, but it did not cause sufficient change for adequate combine harvest. Double-dwarf types of suitable height for combine harvest were developed in the 1940's.

Work continued, and the problem of producing hybrid seed was solved. Sorghum hybrids went into large-scale production in 1956. Seven new hybrids, said to be the first practical sorghum hybrids, were made available to Texas farmers for planting in 1957. Four additional hybrids have been released since that time.

These hybrids are of excellent height for combine harvest - 4 to 5 feet - but they bring with them other characteristics that by far exceed the earlier combine - size varieties and make the expansion of sorghum acreage more desirable. Yields are 20 to 40 percent greater from these plants than from the older varieties; they grow rapidly, are of uniform height, and reach maturity early.

TEXAS' ACREAGE LEADER

Grain sorghum is the largest crop in Texas from the standpoint of acreage harvested - 5,800,000 acres harvested in 1976. Income from grain sorghums has been over $700,000,000 annually for the past 5 years. This represents an increase from 21 percent of Texas' total feed grain production in 1935-39 to about 80 percent at the present time.

The Texas sorghum acreage harvested for forage and fodder was 365,000 acres in 1976.

The wide fluctuations in grain sorghum production was the result of acreage controls on cotton and wheat, seasonal conditions unfavorable for the planting of cotton or wheat and the abandonment of wheat acreage.

About 135 counties in Texas have a substantial amount of acreage devoted to sorghum to be used for grain. About 50 counties were without some acreage of sorghum in the last census. The largest area of concentrated production is the High Plains. The Coastal Bend area around Corpus Christi, including Nueces, San Patricio,

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

and Refugio counties is highly concentrated with acreage in grain sorghum. Other counties with 20 to 70 thousand acres of grain sorghum are scattered on the Rolling Plains, Blackland Prairies, Gulf Coast Prairie, and the Rio Grande Plain. About 70 percent of the High Plains production is under irrigation.

LEADING COUNTIES

The 10 Texas counties which lead in sorghum grain production, in hundred-weights, as shown in the Agricultural Census, with the acreage harvested shown as follows: Nueces, 43,200 acres; Hale, 122,200 acres; Hildalgo, 205,700 acres; Swisher, 105,300 acres; Wharton 161,400 acres; Willacy, 124,900 acres; Cameron, 122,100 acres; Hill, 123,400 acres; Floyd, 93,700 acres; and San Patricio 219,400 acres. There was a big variation in some of these counties in the proportion of the crop grown with and without irrigation.

There are over 500 different varieties of grain sorghum now being raised in the United States. Many of these are hybrids. These varieties may be divided into groups to include milo, kafir, feterita, hegari, and sorgo.

Martin, Redbine 60, Redbine 66, Combine Kafir 60, Plainsman, Caprock, Double-Dwarf Yellow Sooner, Double-Dwarf White Sooner, Early Hegari, Bonita, Westland, and Combine 7078 are some of the early varieties which have played an important role in developing hybrids. Most of our acreage today is planted in hybrids.

Selecting a Grain Sorghum Variety

When selecting a variety of grain sorghums, there are 13 important factors for a person to consider. They are:

1. Compact or loose head - Compact heads are better adapted to arid regions. They will harbor more insects, will not dry as quickly, but usually produce more. Loose heads should be used in humid regions. They do not harbor as many insects and are faster drying.
2. Exsertion - This is the distance of the stalk from the last leaf to the head. The head should be far enough above the last leaf to allow clean combining.
3. Lodge resistance - Plants should have strong stalks which are able to hold up heavy heads without lodging (falling over).
4. Uniform height - Stalks of uniform height mean fewer height adjustments of the combine when harvesting. Stalks above normal height in the field may cause combining problems.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

5. Head drying - There are 3 classes of sorghums according to maturing characteristics - dry, semi-dry, and green. The dry headed is preferred. These classes will have dry heads, but the leaves and stalks remain green. This allows early harvesting and also reduces lodging.
6. Tillering - This is the growing of a secondary head (sucker head) from the nodes of the plant. Later harvesting may be necessary because the secondary head does not mature as soon as the primary head.
7. Size of seed - Larger seeds are preferred by livestock producers as they are more palatable.
8. Hardness of Seed - Soft seed are preferred by livestock producers as they are more palatable.
9. Drought resistance -
10. Insect and disease resistance -
11. Even-maturing - This insures harvesting at a time before lodging takes place.
12. Threshing quality - A variety that will thresh easily in the combine but will not shatter in the field is desired.
13. Grazing quality - Stems and leaves should be palatable if crop is to be grazed after harvesting.

Water and Fertilizer Requirements

In favorable years, high yields of grain can be obtained from as little as 16-18 inches of water. If the weather is extremely hot and dry, 24 inches of water will be required for the same yield.

Grain sorghums respond most favorably to nitrogen fertilizers while only a small response is shown to potash or phosphorus fertilizers. Soils should be tested and recommendations for local area carried out in a fertilizing program for grain sorghums. Some fertilizers will be applied to the soil before planting; others will be applied as a side dressing, and in irrigated areas they may be applied in the irrigation water.

Planting Grain Sorghums

Because grain sorghums are warm-weather crops, one important factor in determining the time to plant is soil temperature. Poor stands are likely to result if grain sorghum is planted in damp, cool soil. It is recommended that soil temperature (2 inches below the surface) be at least 70° F. Planting at this time will give better germination and there will be less seedling disease problems.

Normally grain sorghums are planted at a depth of 1-2 inches. Usually they are planted in rows (14 to 40 inches) but they may also be drilled. Under irrigation they may be double rowed. For dry-land conditions, four to six pounds per acre are planted. For humid or irrigated conditions, this is increased to 6-12 pounds. Regular planters with grain sorghum plates or grain drills may be used.

Cultivating Grain Sorghums

The main reason for cultivating grain sorghums is to control weeds, thus providing more moisture and plant nutrients available for the crop. Cultivation should be shallow only done often enough to keep weeds down. Feeder roots of the plant should not be cut during cultivation if possible.

"Go devils", knives, rotary hoes, and regular row crop cultivators may be used. Selective herbicides may also be used for controlling weeds.

Harvesting Grain Sorghums

Grain sorghum is combined, if harvested for grain, and should be done as soon as the moisture content of the grain falls to 12 percent. If the moisture content is higher than this when grain is harvested, it is difficult to store the grain. "Wet" or "green" grain heats and molds quickly. However, harvesting should not be delayed until lodging or bird damage takes place.

Sorghum Diseases

Disease attacking sorghums may be divided into four classes:

(1) Diseases that rot the planted seed or attack and kill the young seedling
(2) Diseases that attack the leaves of the plant and reduce forage value
(3) Diseases that attack the head and prevent the normal development or formation of grain
(4) Diseases that cause the stalks or roots to rot and thus prevent normal plant development.

Diseases falling into group 1 above are caused by various fungi. Fungi causing seed to rot in the soil usually belong to the following fungi species: Fusarium, Aspergillus, Rhizopus, Rhizactonia, Penicillium, and Helminthosporium. The chief fungus attacking young seedlings belongs to the Pythium species. These diseases are most common during cold, damp weather and may be controlled by seed treatment and careful selection of seed.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

Diseases attacking the leaves cause varying degrees of damage, from small spots or stripes up to the entire leaf. Normally hot, humid weather favors these diseases which may be caused by either bacteria or fungi. Seed treatment and resistance varieties are control measures used on these diseases.

Most head (grain development) diseases are commonly called smuts, or fungi diseases, and are grouped into covered kernel smuts, loose kernel smuts, and head smuts. Good sanitation practices, seed treatment, use of smut-free seed, and use of resistant varieties are the chief methods of controlling these diseases.

There are three main root and stalk diseases; they are periconia root rot (milo disease), stalk rot, and weak neck. All of these are fungi diseases and normally do not appear until the crop is nearing maturity. Use of resistant varieties is the main way to control these diseases.

Grain Sorghum Standards

Official Grain Standards of the United States for Grain Sorghums:

TERMS DEFINED:

These are the official grain standards of the United States for grain sorghum (Sorghum vulgare):

a. Grain sorghum is any grain which, before the removal of dockage, consists of 50 percent or more of whole kernels of grain sorghum, which contains not more than 10.0 percent of other grains for which standards have been established under the United States Grain Standards Act.

b. Classes of grain sorghum are as follows: Yellow Grain, White Grain, Brown Grain, and Mixed Grain.

    (1) Yellow Grain Sorghum is grain sorghum with yellow, salmon-pink, or red seedcoats, which contains not more than 10.0 percent of grain sorghum of other colors.

    (2) White Grain Sorghum is grain sorghum with white seedcoats, which contains not more than 10.0 percent of grain sorghum of other colors.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

Colored spots upon kernels of grain sorghum otherwise white do not affect their classification as White Grain Sorghum. Grain sorghum with white seedcoats and brown subcoats is not classed as White Grain Sorghum.

(3) Brown Grain Sorghum is grain sorghum with brown seedcoats, which contains not more than 10.0 percent of grain sorghum of other colors. Grain sorghum with white seedcoats and brown subcoats is classed as Brown Grain Sorghum.

(4) Mixed Grain Sorghum is grain sorghum which does not meet the requirements for the other classes.

c. Grades shall be the numerical grades, sample grade, and special grades.

d. Dockage is sand, dirt, finely broken kernels of grain sorghum, weed seeds, and any other material which will pass readily through a 2 1/2/64 round hold sieve.

e. Broken kernels, foreign material, and other grain refers to all matter including kernels and pieces of kernels of grain sorghum, except dockage, which will pass readily through a 5/64 triangular hole sieve and all matter, except grain sorghum, which remains on the sieve after sieving.

f. Other grains are barley, hull-less barley, corn, flaxseed, oats, rye, soybeans, wheat, cultivated buckwheat, Polish wheat, popcorn, poulard wheat, rice, spelt, sweet corn, wild oats, and nongrain sorghum.

g. Nongrain sorghum refers to seeds of sweet sorghum (sorgo), sorghum-sudan grass hybrids, sorgrass, broomcorn, johnson grass, and Sudan grass.

h. Damaged kernels (total) are kernels and pieces of kernels of grain sorghum and other grains which are heat-damaged, sprouted, frosted, badly ground-damaged, badly weather-damaged, moldy, diseased, or otherwise materially damaged.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

i. Heat-damaged kernels are kernels and pieces of kernels of grain sorghum and other grains which are materially discolored and damaged by heat.

j. Stones are concreted earthy or mineral matter and other substances of similar hardness that do not readily disintegrate in water.

k. 5/64 triangular hole sieve is an aluminum sieve 0.0319 inch thick with equilateral triangular perforations, the inscribed circles of which are 0.0781 (5/64) inch in diameter and which are 1/4 inch from center to center. The perforations of each row are staggered in relation to the adjacent row.

l. 2 1/2/64 round hole sieve is an aluminum sieve 0.0319 inch thick perforated with round holes 0.0319 (2 1/2/64) inch in diameter which are 0.075 inch from center to center. The perforations of each row are staggered in relation to the adjacent row.

PRINCIPLES GOVERNING APPLICATION OF STANDARDS:

The following principles apply in the determination of the classes and grades of grain sorghum:

a. Basis of determinations. Determination of "broken kernels, foreign material, and other grains" is made on the basis of the grain free from dockage. Class, damaged kernels, heat-damaged kernels, and stones are determined on the basis of the grain, free from dockage, as well as that part of the broken kernels, foreign material, and other grains which can readily be removed by the use of a 5/64 triangular hole sieve. All other determinations are made on the basis of the grain as a whole.

b. Percentages are based on weight. The percentage of dockage when equal to 1 percent or more is stated in terms of whole percent and when less than 1 percent is not stated. A fraction of a percent is disregarded.

c. Moisture is ascertained by the air-oven method for grain sorghum prescribed by the United States Department of Agriculture as described in Service and Regulatory Announcements issued by the Agricultural Marketing Service, or by any method which gives equivalent results.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

d. Test weight per bushel is the weight per Winchester bushel, as determined by the method prescribed by the United States Department of Agriculture.

Grades, Grade Requirements and Grade Designations

The following grades, grade requirements, and grade designations are applicable under these standards:

Grain Sorghum

(a) Grades and grade requirements for the classes Yellow Grain Sorghum, White Grain Sorghum, Brown Grain Sorghum, and Mixed Grain Sorghum.

Grade	Minimum test weight per bushel	Maximum limits of — Moisture	Damaged kernels		Broken kernels foreign material and other grains
			Total	Heat-damaged kernels	
	Pounds	Percent	Percent	Percent	Percent
1...............	57	13.0	2.0	0.2	4.0
2...............	55	14.0	5.0	.5	8.0
3...............	53	15.0	10.0	1.0	12.0
4...............	51	18.0	15.0	3.0	15.0
Sample grade....	Sample grade is grain sorghum which does not meet the requirements of any of the grades from No. 1 to No. 4, inclusive; or which contains stones, is musty, sour, heating, badly weathered, has any commercially objectionable foreign odor except smut, or which is otherwise of distinctly low quality.				

Grain sorghum which is distinctly discolored is not to be graded higher than No. 3.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

GRADE DESIGNATIONS

Grade designation for all classes of grain sorghum. The grade designation for grain sorghum includes, in the order named, number of grade or the words "Sample grade", as the case may be; name of class; name of each applicable special grade; and when applicable the word "dockage" together with the percentage thereof. In the class, Mixed Grain Sorghum, grade designation shall also include, following name of the class, the approximate percentage of yellow grain sorghum, white grain sorghum, and brown grain sorghum in the mixture.

SPECIAL GRADES FOR GRAIN SORGHUM:

Special grades, special grade requirements, and special grade designations for grain sorghum.

Smutty grain sorghum.

Requirements. This is grain sorghum which has kernels covered with smut spores or which contains 20 or more smut masses in 100 grams of grain sorghum.

Grade designation. Grain sorghum is graded and designated according to the grade requirements of the standards applicable to such grain sorghum if it were not smutty, and the word "smutty" is added to and made a part of the grade designation.

Weevily grain sorghum.

Requirements. This is grain sorghum which is infested with live weevils or other live insects injurious to stored grain.

Grade designation. Grain sorghum is graded and designated according to the grade requirements of the standards applicable to such grain sorghum if it were not weevily, and the word "weevily" is added to and made a part of the grade designation.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Information Sheet continued)

Interpretation with respect to the term "distinctly low quality":

The term "distinctly low quality", when used in the official grain standards of the United States, is construed to include grain which contains more than two crotalaria seeds (Crotalaria spp.) in 1,000 grams of grain.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Peanuts

OBJECTIVE: To develop an understanding of the economic importance of peanuts as a major crop in Texas.

REFERENCES:

Required:

1. Plant Science, Janick and others, pp. 437-439, 517.
2. Farm Machinery and Equipment, Smith, pp. 395-399.
3. Information Sheet, "Peanuts".

QUESTIONS OR ACTIVITIES:

1. Give a brief history of the peanut as a crop.
2. What are the major uses of the peanut?
3. What are the natural hazards to peanut production?
4. Name 4 groups (classes) of peanuts.
5. What are some leading varieties of Spanish peanuts?
6. What are 3 factors to consider when selecting a variety of peanuts?
7. If 2 1/2 tons of hay and 1 1/2 tons of nuts were produced on an acre of land, how many pounds of each of the major nutrients would be taken from the soil?
8. When should peanuts be planted?
9. At what rates are peanuts planted?
10. What equipment is used for planting peanuts?
11. Why cultivate peanuts?
12. Name the 3 steps in the peanut harvesting operation.
13. Explain the digging operation in peanut harvesting.
14. Explain the shaking operation in peanut harvesting.
15. What 3 types of machines are used to separate the nut from the vine?
16. Explain the difference between peanut pickers and peanut threshers.
17. What is the main difference between a picker and a combine for harvesting the nut from the vine?
18. What precaution must be taken with combined peanuts before they can safely be stored?
19. What are the major peanut insects?
20. What are the major peanut diseases?

Information Sheet
on
PEANUTS

Peanut Production

Peanuts are the second most valuable oil crop grown in Texas. Peanut production has increased in recent years and Georgia has become the largest producer of peanuts in the United States, followed by Texas. In 1976 there were 304,000 acres of peanuts harvested in Texas. This total number of acres produced 463,600,000 pounds.

Peanuts yield best when there is moderate rainfall during the growing season, plenty of sunshine, and high temperatures. Plants need plenty of moisture from the time they first start blooming until 2 weeks before harvesting. Best yields are from areas of 42-54 inches of annual rainfall but are also grown in areas with as little as 19 inches of rainfall. Most varieties of peanuts need 110-150 day growing season.

There are four groups of peanuts—Virginia, Runner, Spanish, and Valencia. Most peanuts raised in Texas are of the Spanish group. Leading varieties are Dixie Spanish, Argentine, Starr, Spantex, Spanette, Comet, and Spanhoma. Three important things to consider when selecting a variety are (1) adaptability, (2) high vigor, and (3) high germination.

Peanuts should be planted after soil temperature reaches 75° F. In Texas this may vary from March 1 in southern Texas to May 15 in northern Texas. Special peanut planters or corn or cotton planters equipped with peanut plates may be used. Seeding rates will vary from 35-130 pounds per acre depending upon moisture available in the area. Some studies show that two rows 10 inches apart planted on 38-40 inch seedbed when planted at 100 pounds per acre give the best yields. There is a trend to have rows 10 inches apart for dry land conditions and 5 inches apart for irrigated land.

Major insects attacking peanuts include the corn earworm, thrips, white grubs (wireworms), lesser cornstalk borer, cutworm, red-necked peanut worm, grasshoppers, velvet bean caterpillars, fall army worm spidermites, and the southern corn rootworm.

Major peanut diseases include leaf spot, southern blight, stem rot (white mold), pod breakdown, sting nematode, root knot nematode, meadow nematode, collar rot, and peanut rootrot.

APPROXIMATE POUNDS PER ACRE of NUTRIENTS in the SIZE of the CROP (ACRE YIELD) SHOWN

CROP	ACRE YIELD	NITROGEN	PHOSPHORUS	POTASSIUM	CALCIUM
Corn (grain)	60bu.	54	21	16	1
Oats (grain)	80bu.	50	20	15	2
Barley (grain)	40bu.	35	15	10	1
Sorghum (grain)	60bu.	48	25	15	3
Wheat (grain)	50bu.	62	31	18	1
Peanuts (nuts)	1.5 tons	100	12	16	2
Cotton (seed+lint)	1500 lbs.	40	20	15	2
Soybeans	40 bu.	150	35	55	7
Alfalfa Hay	4 tons	180	40	180	112
Peanut Hay	2-½ tons	115	28	100	68
Potatoes (tubers)	400 bu.	80	30	150	3
Tomatoes	15 tons	90	27	120	5

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Rice

OBJECTIVE: To develop an understanding of the economic importance of rice as a major crop in Texas.

REFERENCES:

Required:

1. Plant Science, Janick and others, pp. 416-419.
2. "Keys to Profitable Rice Production", Texas Agricultural Extension Service, L-894.
3. Farm Machinery and Equipment, Smith, Ch. 18, pp. 329-340.
4. Machines for Power Farming, Stone and Gulvin, Ch. 32, pp. 470-491.

QUESTIONS OR ACTIVITIES:

1. Give a brief history of rice.
2. What is the main use of rice?
3. What are natural hazards for rice production?
4. What are the major varieties of rice?
5. What factors are considered in selecting a variety of rice?
6. When, at what rates and what methods are used when seeding rice?
7. How much water is required to produce a rice crop?
8. How is rice cultivated?
9. How is rice harvested?
10. What are the 2 major differences between rice combines and grain combines?
11. What are the major rice insects?
12. What are the major rice diseases?

Information Sheet
on
RICE

The same natural hazards in producing other crops are also found in rice production. For example, plant pests include diseases, insects, and weeds. Hail and strong winds are the two most prevalent climatic hazards.

Commercial varieties of rice grown in the United States are classified as short, medium and long-grain varieties. The Texas crop is over 95 percent long-grain rice. Short-grain varieties are grown almost exclusively in California and medium-grain varieties are grown principally in Arkansas and Louisiana. Varieties also may be grouped as early, midseason, and late, according to the number of days required to reach maturity. In Texas, early maturing varieties require 109 to 132 days from seeding to maturity; midseason maturing varieties, 133 to 150 days; and late maturing varieties, 150 to 180 days. These types, with examples of varieties under each are:

> Long-grain varieties: Century Patna 231 (early), Bluebonnet 50 (midseason), Rexoro (late), TP 49 (late), Texas Patna (late), Improved Bluebonnet (midseason), Sunbonnet (midseason) and Toro (midseason).
>
> Medium-grain varieties: Zenith (early), Nato (early), and Magnolia (early).
>
> Short-grain varieties: Asahi (midseason) and Caloro (midseason).

Yield is one of the most important characteristics to consider in selecting a variety. Milling and table qualities, date of maturity, disease resistance, stiffness of straw, and type of grain should be considered also. Producers with large acreages usually spread their harvest date by growing two or more varieties that differ in date of maturity and type of grain, or they may stagger dates of seeding. This practice protects the farmer from adverse weather conditions during the seeding and harvesting periods. It also gives better distribution of labor, more efficient use of harvesting machinery and offers some protection against the fluctuation of prices among varieties.

A large portion of Texas rice acreage is seeded by airplane, both on dry and flooded fields.

Presoaked seed are ordinarily used for water seeding. The seed are soaked until signs of germination appear and then are sown. Water seeding has proven to be successful in controlling barnyard grass. Weather conditions are less likely to interfere with the desired time of seeding. Through water seeding the farmer has

UNIT: Major Crops
TOPIC: Rice
(Information Sheet continued)

more assurance of getting a stand of rice, more uniform ripening and higher yields, if grass is a serious problem. Water seeding is not recommended before April 10 to 15.

Dry seed are used for airplane seeding and other types of broadcasting on dry soil. The fields are harrowed following seeding, flushed to promote germination, and then resubmerged in time to control weeds and grass.

A large acreage of rice is seeded with regular grain drills and cultipacked, particularly on sandy loam soils. Germination is affected by the moisture available in the soil. The field should be flooded with water when the rice seedlings reach a height of 4 to 6 inches or before weeds become a problem.

Uniform stands provide greater yields and insure even maturity. Rice which is evenly matured is graded higher and commands a higher price.

Texas farmers seed rice from March 1 to late June. Most of the acreage is seeded in April and May, depending on the weather, method of seeding, soil conditions, and expected maturity. Early-sown seed germinate slowly and may rot because of low temperatures while late-seeded rice germinates more rapidly. When sown early in the spring, medium-grain varieties such as Zenith usually produce better stands than long-grain varieties. Medium-grain varieties seem more tolerant to low temperatures during germination and early seedling growth. Experiments reveal there is not much difference in yields obtained from seedings made between April 15 and June 1, but they are frequently lower when seedings are made earlier or later than this period.

Date of seeding affects the time required for rice to mature. Time required for a given variety to mature decreases as the seeding date is delayed. In experimental plots, Rexoro, Texas Patna, and TP 49 seeded the second week of June have been total failures due to frost. Early varieties may be sown as late as June 15, midseason varieties as late as June 5 and late-maturing varieties as late as May 20.

The amount of water needed in irrigating rice is governed by the amount and distribution of rainfall, temperature, humidity, evaporation rate, kind of soil, and the watering practices followed by the individual grower. Rice requires more water in dry years than in wet ones because there is more evaporation. Sandy soils, such as Katy and Hockley fine sandy loams, require more water than heavy soils such as Beaumont and Lake Charles clay because of greater losses by percolation and seepage.

UNIT: Major Crops
TOPIC: Rice
(Information Sheet continued)

Approximately 40 to 45 inches of water are used for rice in an average season in Texas. Of this amount, rainfall supplies approximately 20 to 30 inches from May to October.

Methods of irrigating young rice depend on seeding methods used. Where rice is seeded on heavy soils with a grain drill, the fields are usually flushed for germination if water is available and if the soil has not been saturated by rain. Flushing is ordinarily practiced on heavier soils, but not on sandy soils. Where rice is sown in water or the fields are flushed by rain or irrigation, fields should be drained within 12 to 24 hours. Rice is irrigated first when plants reach a height of 4 to 6 inches. Irrigation water is applied to a depth of 1 to 2 inches and is increased gradually to 4 to 6 inches. Additional water is supplied to replace water lost be evaporation, transpiration, and seepage.

Rice fields should be drained once or twice during the growing season to apply fertilizers or to control straighthead or blight and water weeds. Time and number of drainings vary, depending on the maturity of the variety, presence of weeds and the supply of water. When the soil dries and begins to crack, the field should be reflooded. In some areas, fields are not drained since sufficient water is not available for reflooding.

A flooding period of 3 weeks is usually required to control grass. Rice should be allowed to recover by draining water off as soon as weeds and grass are controlled.

When severe grass infestations occur, farmers sometimes flood crops when the young plants are 2 to 3 inches in height. This completely submerges many plants and should be practiced with caution. In such cases, water should be drained slowly to enable plants to recover. Otherwise, they will be elongated and lodge and their leaves will be covered by water and soil. This procedure is successful when the rice seedlings are taller than grass seedlings; thick stands of rice are present; the land is level, and the weather is clear and warm.

The best milling quality and germination are obtained if rice is harvested at a moisture content of 18 to 22 percent. Rice harvested with a higher moisture content may have a high percentage of light chalky kernels which do not mill well. If harvested after this stage, loss may occur from shattering and inferior milling quality because of checking of the grain. If rice is harvested for seed, it is best to delay harvest until the average moisture content is no higher than 18 percent.

UNIT: Major Crops
TOPIC: Rice
(Information Sheet continued)

Several preharvest chemicals are available commercially, and spraying is recommended if many weeds are in the rice field at harvest time. If rice stubble fields sprayed with these chemicals are to be grazed, the toxicity of the desiccant should be checked with the manufacturer. Several chemicals which are used to hasten maturation may be harmful to livestock.

In 1976, Texas harvested 508,000 acres of rice which averaged 4.810 pounds per acre.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Small Grains

OBJECTIVE: To develop an understanding of the economic importance of the small grains—wheat, oats, barley, and rye—as major crops.

REFERENCES:

Required:

1. Crop Production, Delorit and Ahlgren, pp. 140-206.
2. Plant Science, Janick and others, pp. 419-424, 429-431.
3. Information Sheet, "Small Grains".

QUESTIONS OR ACTIVITIES:

1. What crops are generally referred to as small grains?
2. Give a brief history of wheat, oats, barley, and rye.
3. What are the major uses of each of the 4 small grains?
4. What are the natural hazards of small grain production?
5. What are leading varieties of wheat, oats, and barley?
6. What factors should be considered when selecting a variety of small grains?
7. What general recommendations can be made for fertilizing small grains?
8. When, at what rates, and with what equipment are small grains planted in Texas?
9. Are small grains cultivated?
10. What are the moisture requirements for the small grains?
11. How are small grains harvested?
12. What major diseases damage the small grains?
13. What major insects damage the small grains?
14. What are USDA grades for wheat?
15. What factors determine wheat grades?
16. What are USDA grades for oats?
17. What factors determine grades for oats?

Numerical Grades and Sample Grade and Grade Requirements

WHEAT

(a) Numerical grades and sample grade and grade requirements for all classes of wheat except mixed wheat.

Grade	Minimum test weight per bushel		Maximum limits of - - - -						
	Hard Red Spring-Wheat or White Club Wheat	All other classes	Defects					Wheat of other classes[1]	
			Heat-damaged kernels	Damaged kernels (total)	Foreign material	Shrunken and broken kernels	Defects (total)	Contrasting classes	Wheat of other classes (total)
	Pounds	Pounds	Percent	Percent	Percent	Percent	Percent	Percent	Percent
1	58.0	60.0	0.1	2.0	0.5	3.0	3.0	1.0	3.0
2	57.0	58.0	.2	4.0	1.0	5.0	5.0	2.0	5.0
3	55.0	56.0	.5	7.0	2.0	8.0	8.0	3.0	10.0
4	53.0	54.0	1.0	10.0	3.0	12.0	12.0	10.0	10.0
5	50.0	51.0	3.0	15.0	5.0	20.0	20.0	10.0	10.0
Sample grade....	Sample grade shall be wheat which does not meet the requirements for any of the grades from No. 1 to No. 5, inclusive; or which contains more than two crotalaria seeds (Crotalaria spp.) in 1,000 grams of grain, or contains castor beans (Ricimus communis), stones, broken glass, animal filth, unknown foreign substances, or commonly recognized harmful or toxic substances; or which is musty, sour, or heating; or which has any commercially objectionable foreign odor except of smut or garlic; or which contains a quantity of smut so great that any one or more of the grade requirements cannot be applied accurately; or which is otherwise of distinctly low quality.								

[1] Red Durum Wheat of any grade may contain not more than 10.0 percent of wheat of other classes.

UNIT: Major Crops
TOPIC: Small Grains
(Information Sheet continued)

OATS

(a) Grades and grade requirements for the classes white oats, red oats, gray oats, black oats, and mixed oats.

Grade	Minimum limits of - - - -		Maximum limits of - - - -		
	Test weight per bushel	Sound cultivated oats	Heat-damaged kernels	Foreign materials	Wild oats
	Pounds	Percent	Percent	Percent	Percent
1[1]	34	97	0.1	2.0	2.0
2[2]	32	94	.3	3.0	3.0
3[3]	30	90	1.0	4.0	5.0
4[4]	27	80	3.0	5.0	10.0
Sample grade....	Sample grade shall be oats which do not meet the requirements for any of the grades No. 1 to No. 4, inclusive; or which contain more than 16.0 percent of moisture; or which contain stones; or which are musty, or sour, or heating; or which have any commercially objectionable foreign odor except of smut or garlic; or which are otherwise of distinctly low quality.				

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[1] The oats in grades No. 1 white oats may contain not more than 5.0 percent of red oats, gray oats, and black oats, singly or in combination, of which not more than 2.0 percent may be black oats.

[2] The oats in grade No. 2 white oats may contain not more than 3.0 percent of black oats.

[3] Oats that are slightly weathered shall be graded not higher than No. 3.

[4] Oats that are badly stained or materially weathered shall be graded not higher than No. 4.

The following grades, grade requirements, and grade designations are applicable under these standards:

BARLEY

(a) Grades and grade requirements for the subclass barley of the class barley.

Grade	Minimum limits of - - - -		Maximum limits - - - -					
	Test weight per bushel		Total damaged kernels	Heat-damaged kernels	Foreign materials	Broken kernels	Thin barley	Black barley
	Pounds	Percent	Percent	Percent	Percent	Percent	Percent	Percent
1	47	97	2.0	0.2	1.0	5.0	10.0	0.5
2	45	94	4.0	.3	2.0	10.0	15.0	1.0
3	43	90	6.0	.5	3.0	15.0	25.0	2.0
4[1]........	40	80	8.0	1.0	4.0	20.0	35.0	5.0
5	36	70	10.0	3.0	6.0	30.0	75.0	10.0
Sample grade....	Sample grade shall include barley of the class barley, which does not come within the grade requirements of any of the grades from No. 1 to No. 5, inclusive; or which contains more than 16.0 percent of moisture; or which contains stones; or which is musty, or sour, or heating; or which has any commercially objectionable foreign odor except of smut or garlic; or which contains a quantity of smut so great that any one or more of the grade requirements cannot be applied accurately; or which is otherwise of distinctly low quality.							

[1] Barley that is badly stained or materially weathered, shall not be graded higher than No. 4.

UNIT: Major Crops
TOPIC: Small Grains
(Information Sheet continued)

RYE

Grade requirements for rye.

Grade	Minimum test weight per bushel	Maximum limits of - - - -			
		Damaged kernels (rye) and other grains		Foreign material	
		Total	Heat-damaged	Total	Foreign matter other than wheat
	Pounds	Percent	Percent	Percent	Percent
1[1]........	56	2	0.1	3	1
2[1]........	54	4	.2	6	2
3[1]........	52	7	.5	10	4
4	49	15	3.0	10	6
Sample grade....	Sample grade shall include rye which does not come within the requirements of any of the grades from No. 1 to No. 4, inclusive; or which contains more than 16 percent of moisture; or which contains inseparable stones and/or cinders; or which is musty, or sour, or heating, or hot; or which has any commercially objectionable foreign odor except of smut or any one or more of the grade requirements cannot be applied accurately; or which is otherwise of distinctly low quality.				

[1] The rye in grade No. 1 may contain not more than 10.0 percent, in grade No. 2 not more than 15.0 percent, and in grade No. 3 not more than 25.0 percent of "thin" rye shall consist of rye and other matter that will pass readily through a sieve 0.032 inch thick with perforations 0.064 by 0.375 inch.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Cowpeas

OBJECTIVE: To develop an understanding of the importance of cowpeas as a major crop.

REFERENCES:

Required:

1. Plant Science, Janick and others, p. 442.
2. Information Sheet, "Cowpeas".

QUESTIONS OR ACTIVITIES:

1. Give a brief history of the cowpea.
2. What are the uses of cowpeas?
3. What are the natural hazards to cowpea production?
4. Name some important cowpea varieties.
5. Cowpeas respond best to applications of which plant nutrients?
6. When, how, and at what rates are cowpeas planted?
7. What methods are used to cultivate cowpeas?
8. Cowpeas grow best under what climatic conditions?
9. How are cowpeas harvested?
10. Cowpeas are susceptible to what diseases?
11. What insects are associated with cowpeas?

Information Sheet
on
COWPEAS

Cowpeas are not native to this country as are certain types of beans. They were introduced in the United States from Africa in the early 1700's. These peas are warm weather plants; therefore, they are widely grown in the southern states. Peas grow best in humid climates, and they cannot withstand even the lightest of frost. They will grow on either light or heavy soils that are well drained. Most varieties of cowpeas are produced in medium fertile soils. If it is necessary to use a commercial fertilizer, one that is high in phosphorus and potassium and low in nitrogen is recommended. Soils that are highly fertilized tend to produce vine instead of fruit. The leading states in cowpea production are: South Carolina, Georgia, Texas, Oklahoma, and North Carolina. Texas harvested 14,000 acres of dried peas and 6,600 of green peas in 1976.

Cowpeas are grown for human consumption, seed, hay, pasture, silage, soil improvement, and green manure crops. A small amount of the dried seed (about 20 percent) is used as livestock feed. Most cowpeas that are grown for human consumption are consumed green.

Cowpeas are still being used on a limited basis as a green manure crop in the southern states. Such a practice improves the soil tilth and increases the fertility. It also reduces soil loss through erosion.

There are several varieties of cowpeas, but some of the more common are: Whippoorwill, Victor, Groit, New Era, Brabham, Iron, and Blackeyed.

Cowpeas are susceptible to many natural hazards that are found among other plants. The most common pathogens (diseases) that attack cowpeas are root knot and common wilt. Other diseases include: charcoal rot, red leaf spot, zonate leaf spot, and powdery mildew. There are several insects that destroy the cowpea, but the two that do more damage than most others are the cowpea weevil and cowpea curculio. The other major plant pest (weeds) is found in all growing crops unless the soil has been treated properly with a herbicide or proper cultivation is practiced. Too little or excessive moisture are also considered hazards in cowpea production. The improper temperature (frost) in early spring or late fall is always a hazard unless peas are planted at the proper time.

Cowpeas are usually planted from about May 1 to August 1, depending upon the use of the crop. However, they should not be planted within 90 days of the first fall frost. Peas are usually planted with a corn or cotton planter unless they are used for hay, pasture, or green manure crop, then they should be planted with a drill. Usually 2 - 3 pecks per acre are used when planted in rows, and 5 - 8 pecks per acre are used when sown with a drill.

UNIT: Major Crops
TOPIC: Cowpeas
(Information Sheet continued)

The type of equipment used to harvest cowpeas depends upon the use of the pea. The different methods of harvesting are:

Hay - When hay is harvested the entire plant is cut, usually in the blooming stage. A conditioner type mower, rake, or windrower and baler are used.
Seed - Seed is harvested in quantities by using combines equipped with a 3/8" or 1/2" round hole sieve. The combine may also be equipped with a perforated grain pan, a perforated shoe floor, a stone trap, and wide rear axle to better adapt for this type of harvesting. Climatic conditions are very important during cowpea harvest. For example, in humid regions it may be necessary to cut and windrow cowpeas and let them thoroughly dry before threshing them with a combine.
Pasture - Even though cattle will eat the green cowpea, they are most commonly grazed by swine.
Silage - When planted alone or with some other crop for silage, the cowpea is harvested similarly to other crops by using a forage harvester.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Soybeans

OBJECTIVE: To develop an understanding of soybeans as a major crop in Texas.

REFERENCES:
Required:
1. Plant Science, Janick and others, pp. 436-437, 520.
2. Crop Production, Delorit and Ahlgren, pp. 410-430.
3. Information Sheet, "Grades of Soybeans".

QUESTIONS OR ACTIVITIES:

1. Give a brief history of the soybean plant.
2. What are soybeans used for?
3. What are natural hazards to soybean production?
4. How do varieties of soybeans differ?
5. What are the 3 classes of soybean varieties?
6. What 2 factors are considered in selecting a soybean variety?
7. What are some leading soybean varieties?
8. What effect do phosphorus and potassium fertilizers have on soybeans?
9. When, how, and at what rate should soybeans be planted?
10. What cultivation practices are recommended for soybeans?
11. What are the moisture requirements for soybeans?
12. How are soybeans harvested?
13. What are the major insects attacking soybeans?
14. What are minor soybean insects?
15. What diseases attack soybeans?
16. What are the USDA grades for soybeans?
17. What factors determine grades for soybeans?

Information Sheet
on
GRADES OF SOYBEANS

Grades, grade requirements, and grade designations

The following grades, grade requirements, and grade designations are applicable under these standards:

SOYBEANS

(a) Grades and grade requirements for soybeans.

Grade	Minimum test weight per bushel	Maximum limits of - - - -					
		Moisture	Splits	Damaged kernels		Foreign material	Brown, black and/or bicolored soybeans in yellow or green soybeans
				Total	Heat-damaged		
	Pounds	Percent	Percent	Percent	Percent	Percent	Percent
1	56	13.0	10	2.0	0.2	1.0	1.0
2	54	14.0	20	3.0	0.5	2.0	2.0
3[1]	52	16.0	30	5.0	1.0	3.0	5.0
4[1]	49	18.0	40	8.0	3.0	5.0	10.0
Sample grade.	Sample grade shall be soybeans which do not meet the requirements for any of the grades from No. 1 to No. 4, inclusive; or which are musty, sour, or heating; have any commercially objectionable foreign odor; contains stones; or which are otherwise of distinctly low quality.						

[1] Soybeans which are purple mottled or stained shall be graded not higher than No. 3.

[1] Soybeans which are materially weathered shall be graded not higher than No. 4.

Assignment Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Alfalfa and Clover

OBJECTIVE: To develop an understanding of why alfalfa and clover are important to Texas Agriculture.

REFERENCES:
Required:
1. Crop Production, Delorit, pp. 279-314, 317-360.
2. Plant Science, Janick and others, pp. 445-447.
3. Information Sheet, "Alfalfa and Sweet Clover".

QUESTIONS OR ACTIVITIES:

1. Tell where alfalfa was first grown and how it spread to the United States.
2. What are the uses of alfalfa and sweet clovers?
3. What are natural hazards to alfalfa and sweet clover production?
4. What are the major varieties of alfalfa as reported by the USDA Survey 1969 and those reported before 1940, 1940 - 1955, and since 1955?
5. What major factors are considered when selecting a variety of alfalfa or sweet clover?
6. What are the 3 nutrients most required by alfalfa?
7. When, and at what rates, should alfalfa be sowed?
8. When should alfalfa be cultivated?
9. How often should alfalfa be irrigated?
10. How are alfalfa and sweet clovers harvested?
11. What are the chief types of diseases and insects attacking alfalfa?
12. What is good quality alfalfa hay?
13. Give a brief history of sweet clovers as a crop.
14. What are the major species of sweet clover raised in Texas?
15. What 2 nutrients are required in the greatest amounts by sweet clovers?
16. When, and at what rates, should sweet clovers be planted in Texas?

Information Sheet
on
ALFALFA AND SWEET CLOVER

Alfalfa

FERTILIZATION

Alfalfa feeds heavily on phosphorus, potassium and calcium (lime). A ton of alfalfa hay contains roughly 45 pounds of nitrogen, 12 pounds of phosphoric acid and 45 pounds of potash. Once established, the plants are usually able to get their supply of nitrogen from the air. Failure to obtain needed phosphorus, potassium, and calcium results in low-producing plants and loss of stand. The best way to determine the grade and amount of fertilizer required is by testing the soil before seeding, and every 2 to 3 years thereafter.

Phosphorus is needed for alfalfa production on East, South, and Central Texas soils and a few West Texas soils. Potassium is needed also in East Texas. Upland sandy loam soils in East Texas require lime as do some sandy loam and clay soils on the Gulf Coast Prairie.

Barnyard or poultry house manure is excellent for alfalfa, because it supplies organic material and plant nutrients. The manure should be applied far enough in advance of seeding that it will be well incorporated with the soil. Barnyard manure which may contain seed of noxious weeds should not be used.

Establishment. Fertilizer should be drilled into the soil 3 to 4 inches deep with a drill attachment at seeding time. It should be placed in a band below the seed 2 to 3 inches to the side and below. Fertilizer may be broadcast and worked into the soil before seeding, but this method encourages more weed growth, phosphorus fixation by lime and more of the nitrogen and potassium may be lost by leaching. Lime should be applied preceding or during seedbed preparation. Fifteen to twenty pounds per acre of nitrogen applied at seeding time adequately stimulates seedling growth. More than this amount on fertile soils encourages weed and grass growth also.

Maintenance. Alfalfa stands maintained for several years should have required phosphoric acid and potash added to them once a year by being drilled in or applied as a topdressing in early fall, late winter, or early spring. When the fertilizer is topdressed, the soil surface may be scratched or tilled to permit partial incorporation.

UNIT: Major Crops
TOPIC: Alfalfa and Clover
(Information Sheet continued)

Some alfalfa growers in East Texas use large amounts of fertilizer to establish and maintain stands on the upland and sandy loam soils. These growers apply fertilizer at the rate of about 25-100-100 per acre at the time of, or just prior to, seeding in the fall. In March and after each cutting, the plants are top-dressed with 30 pounds per acre of nitrogen. After the last cutting in the fall and following rains, established stands receive an application of about 25-100-150 per acre. Some stands are reported to have lasted 10 years with such fertilizer treatment.

ALFALFA CULTIVATION

Tests show that cultivating drilled or broadcast stands of alfalfa offers no advantage if the stand is good and the plants are making good growth. If the soil has been compacted by grazing livestock or machinery or heavy silt deposits have been left by overflows or irrigation, some tillage may be desired. Alfalfa stands are often tilled to work fertilizer into the soil. Alfalfa tillers or harrows are probably the best implements to use because they do not rip out the plants.

INSECTS

The most important insects attacking alfalfa in Texas are the spotted alfalfa aphid, pea aphid, grasshoppers, three-cornered alfalfa hopper, alfalfa caterpillar, lygus bugs, and thrips. The spotted alfalfa aphid is currently the most serious threat to alfalfa and may destroy stands if not controlled. The insect sucks sap from the plants, causing the leaves to turn yellow and the lower ones to drop off. The insect secretes honeydew in which molds develop.

DISEASES

Two types of diseases attack alfalfa. The root diseases may kill the plants, causing reduced stands and yields, while the foliage diseases that attack the leaves and stems lower the yields and quality of forage.

Cotton Root Rot. This probably is the most destructive of all the alfalfa diseases in Texas, for the fungus causing this disease may attack the plants at any stage from seedling to maturity. It is more active in warm weather and is recognized by the circular spots of dead or dying plants. The bark of infected taproots rots and dies, and the plants can be easily broken off at the soil surface. Frequently

UNIT: Major Crops
TOPIC: Alfalfa and Clover
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the brownish, fuzzy strands of the fungus can be seen on the affected roots. No effective control is known. However, incidence of the diseases may be reduced by growing such nonsusceptible crops as grasses for one or more seasons. Root-rot infested land should be avoided in alfalfa production. Alfalfa grown on infested soil should be handled as an annual hay crop.

Seed Rot and Seedling Blight. These diseases often cause poor stands. They are referred to as "damping off" and are caused by soil-inhabiting fungi and molds which may live in the soil for several years. Growth of these organisms is favored by cool, wet weather. Affected seedlings show soft, rotting tissue that soon dries out and causes death of the small plant. To guard against these diseases, the alfalfa seed may be treated with Arasan, Dithane, Z-78, Parzate, or Spergon dust at the rate of 8 ounces per 100 pounds of seed. Seed treated with these chemicals may be inoculated with nitrogen-fixing bacteria if the seed are sown within 2 hours after inoculation.

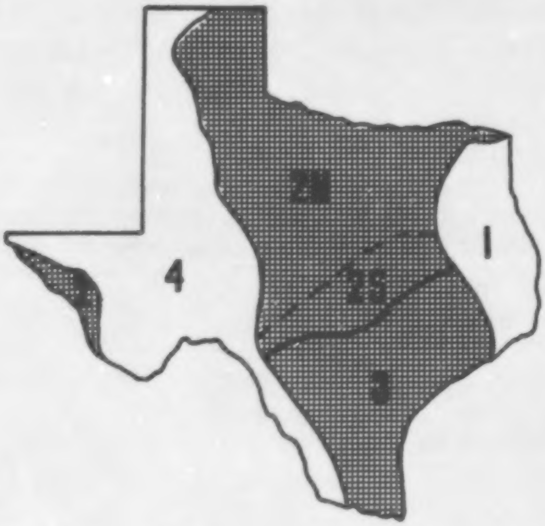
Blackstem. Blackstem occurs in Texas mostly during the spring, for it is most serious in cool, humid climates. The disease may occur on any part of the plant from the upper taproot to the seed pods, and it results in irregular, dead spots on stems and leaves, which gradually enlarge and merge with other dead spots until the stem is girdled entirely. Plants usually are not killed, unless the disease spreads to the crown. Sanitation is important in reducing losses because the fungus overwinters on hay and growth left from the previous year. If the disease is serious, the hay crop should be harvested before leaves are lost so new growth can occur under more disease-free conditions.

Other Leaf Diseases. These include leaf rust, downy mildew, and common leaf spot. Alfalfa leaf rust is recognized by reddish-brown, raised spots on the leaves and sometimes on the stems. Common leafspot may cause considerable loss of leaves, as yellowing and dropping of leaves occurs on infected plants. Downy mildew causes the leaves to curl and turn yellow, and the underside of the leaf becomes covered with a purplish, felt-like growth.

If damaging infestations of these diseases occur, the plants should be cut before leaf loss becomes serious so new growth can occur under more disease-free conditions.

Sweet Clover

AREAS OF ADAPTATION OF SWEET CLOVERS IN TEXAS



Areas of adaptation of sweet clover in Texas. Area 1, not generally recommended; Area 2, biennial white, biennial yellow, annual white (Hubam); Area 2-N, spring planted; Area 2-S, fall planted; Area 3, annual white, annual yellow; Area 4, not recommended except under irrigation.

FERTILIZER

Since sweet clover grows under a wide range of soil and climatic conditions, the soils vary widely in their need for fertilizer, even on the same farm. Maximum yields cannot be obtained unless fertilizer is used in combination with good management practices. Sweet clover has a high requirement for both calcium (lime) and phosphorus. It cannot be grown successfully on soils which remain strongly acid or deficient in either of these minerals. Soil tests should be made before planting sweet clover. When sweet clover is planted on soils high in calcium (such as the Blacklands of Central Texas), it is important to place the superphosphate in bands rather than broadcast. These bands of fertilizer should be approximately 2 inches below the seed.

PLANTING DATES

Biennial varieties may be planted in August and September under irrigation on the High Plains. Otherwise, sweet clover should be spring-planted in late February or early March in Area 2-N, fall or spring-planted in Area 2-S and fall-planted in Area 3. In these areas it often is planted with oats for grazing. The oats make good grazing until late spring, when the clover is ready to supply grazing. The practice of planting sweet clover with small grains for grazing is not too successful in rainfall areas of 30 inches or less.

SEEDING RATES

The seeding rate depends upon factors such as germination of the seed, climate, companion crops, row width desired and the use to be made of the clover. Clover seed may be hulled, unhulled, or scarified. It is important that scarified seed be planted if a good stand is desired immediately after planting. However, nonscarified seed come up over a long period of time, and less risk from unfavorable weather is involved when they are used. In general, the following seeding rates of high-quality seed are recommended per acre, but these rates should be increased under especially favorable environments and decreased in the drouthy regions:

Rows 36 to 42 inches wide - 2 to 3 pounds
Rows 14 to 16 inches wide - 4 to 5 pounds
Overseeding on small grains - 8 to 10 pounds
Drilling alone - 12 to 15 pounds

METHOD OF PLANTING

Sweet clover seed should be planted approximately 1/2 inch deep on a firm seedbed. When planted with small grains, a drill with a small-seed attachment is desirable. The downspouts from the small-seed box may be attached to the rear of the disc boot and the seed allowed to fall behind the disc and then covered with a chain drag or press wheel. Many farmers plant small grain with a drill and then overplant with the same drill. Once sweet clover has produced seed, volunteer stands may come up for several years.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Opportunities in Farming

1. The agricultural industry is one of the most important segments of the world of work. About six million people are engaged in producing food and fiber.

2. During the pioneer days, man could find fertile soil to produce his crops. Weeds were not a serious problem in the new land. Insects and disease were less prevalent than they are today. Most of the crops were produced for domestic use. A knowledge of the economics of farming was of minor importance.

3. The farm population is decreasing. One farmer could produce food and fiber for himself and four other people in the early 1800's. Today the average farmer can produce enough food for himself and about 50 other people.

4. About 25 million people are employed in the agricultural industry.

5. The farms are being made more productive each year.

6. One out of every three people will use some knowledge of his agricultural training.

7. The major occupational areas are:

   a. Production
   b. Supply
   c. Processing
   d. Mechanics
   e. Forestry
   f. Horticulture
   g. Conservation and recreation
   h. Other - Professional

8. The agricultural industry employs the largest number of people.

9. No. Agriculture is considered a big business.

UNIT: Introduction
TOPIC: Opportunities in Farming
(Answer Sheet continued)

10. There are about 6,000,000 people involved in the farming business. However, there are not 6,000,000 farmers living on farms.

11. Yes. Approximately 240 billion are in farming assets in the United States.

12. 1862

13. Morrill Act

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: History of Farming

1. The farmer has to increase production to feed more people on less land.

2. The population has increased, the number of farmers has decreased, and land is being used for non-farming purposes.

3. The needs are met in the following ways:
   By the use of improved varieties
   By control of insects
   By irrigation
   By more advanced production methods
   By more advanced and more economical harvesting methods
   By farming scientifically

4. Wheat, barley, rice, cotton, and sorghums were among the first important crops.

5. 70 percent is adaptable to cultivation.

6. Mexico, South America, Africa, Asia, and Europe.

7. The white potato was discovered in South America.

8. Yes.

9. Barley, corn, and rice were three of the earliest crops grown by man.

10. In Europe in the eleventh century

11. The Egyptians

12. Mexico

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Farming as a Science

1. Agricultural technology has revolutionized agricultural production. Animal power has been replaced by machine power. New varieties of plants and the development of hybrids, in combination with new fertilizers, are some reasons why crop production has been increased.

2. Insecticides, fungicides, and herbicides (2, 4-D) have helped improve crop yields.

3. Cotton production has been affected by the mechanical cotton picker, hybrid cotton varieties, defoliants, and chemical weed control.

4. Changes that improve crop production are necessary in order to provide the food and fiber for an increasing world population.

5. a. It provides the necessary knowledge to improve practices.
   b. It provides the knowledge and skill needed to produce more food on less land.
   c. It provides information for a better education in agronomy, engineering, biology, nutrition, economics, chemistry, pathology, genetics, and entomology.

6. There are approximately 6,000,000 agricultural workers in the nation.

7. Agriculture has continued to be the nation's largest industry.

8. In the 1920's

9. Rice, wheat, corn, grain sorghum, and potatoes

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Economics of a Farm Enterprise

1. A farm enterprise should be discontinued if it cannot be made profitable. Profit in this statement can mean many things. Profit usually means that it costs a farmer less to produce a product than he can sell it for. But many costs are involved in determining how much a farmer needs to receive for his crop. If any of the costs become greater and the production remains the same, then selling price must increase for an enterprise to be "profitable." Also if selling price does not increase, then production should increase to offset the increased costs of production. But these instances are not the only way that an enterprise may become un-profitable.

   An enterprise should be discontinued when another enterprise could be started that would increase the farmer's net returns, if that second enterprise is equally satisfying to the farmer to produce.

2. A farm enterprise should be dropped, discontinued, or phased out when it becomes unprofitable, or when an alternative enterprise looks more favorable. Many times specialized equipment is necessary for a crop, and it is more difficult to stop producing a crop when an entire farming program is set up around this crop, including machinery. In this instance it would probably be more desirable to "phase out" the present crop and go into the new crop more slowly.

   This is especially true if very little is known about the growing of the new crop. But if the new crop has been grown successfully in a particular locality then this new crop can be started on a larger scale. Generally, a good idea to follow is to always be ready to try new enterprises, but never go all out for one enterprise until it is proven to be a profitable enterprise in local situations. Another reason for going into a new enterprise slowly would be to limit mistakes to small beginnings. Then, when the pitfalls have been discovered and the crop is proven, the farmer is ready to get into the new enterprise.

   No change in a farming program is easy, and no farmer likes to change from what he knows to something he knows very little about, but as a future farmer, always be ready to try new possibilities, if they are sound to begin with.

UNIT: Introduction
TOPIC: Economics of a Farm Enterpirse
(Answer Sheet continued)

3. Governmental factors are very important in a farmer's selection of an enterprise. Until recent times only the Federal Government affected the crop farmer in the way of price support payments. It is enough to say that some crops would not be grown in certain areas if the farmer did not receive support payments, and as the result of such a change the farmers would have to resort to alternative crops or enterprises.

   Very recently, Texas Department of Agriculture has begun to affect the crop farmer by finding new outlets, or markets, for crops. This increases demands for crops and that, in turn, increases selling price.

   In addition to direct influence as mentioned above, governmental agencies offer technical and financial assistance to farmers which very often drastically affect which enterprise or enterprises a farmer undertakes.

4. The type of farm enterprise is affected by its demand. The demand, in turn, usually regulates the price.

5. A balanced farm program usually has more than one enterprise, so that the labor and income is more evenly distributed throughout the year.

6. The six economic factors are:

   a. Crop yields
   b. Amount of arable land
   c. Consumer demands
   d. Wars
   e. Export markets
   f. Early markets

7. Some farmers may climb the agricultural ladder. Others may inherit a farm. But most important, successful farmers want to farm, want to be the best farmers around, and want to be as independent as possible. In order to accomplish this, many young men will start out with virtually nothing and by diligent thrift, sound management, and sheer stubbornness become very successful farmers even though they had to work hard to become farmers.

8. The increase or rise in income or consumption of goods per person

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Farming in the United States

1. There are no major farm crops that are now grown in the United States that are native to this country. The crops and their origin are:

Crop	Continent or Country Where Crop Originated
Cotton	Mexico and Asia
Corn	Mexico
Beans	Mexico
Peanuts	South America
Potato	South America
Tobacco	South America
Tomato	South America
Squash	South America
Sweet Potato	South America
Sorghums	Africa
Watermelon	Africa
Beets	Europe
Cabbage	Europe
Apples	Europe
Wheat	Europe
Alfalfa	Asia
Rice	Asia
Soybeans	Asia
Peaches	Asia

2.

Land Use	Percent of Total Land in United States
Crops	20.2% or 45.8 million acres
Grassland and Pastures	27.8% or 633 million acres
Forests	32.8% or 746 million acres
Cities, Roads, Lakes, etc.	6.3% or 142 million acres
Deserts, Swamps, etc.	12.9% or 292 million acres

3. a. Subtropical crops are grown largely in Southwestern California.
   b. Hay and pastures are scattered throughout the United States with the largest concentration being found in the 13 Western States, including Texas.

UNIT: Introduction
TOPIC: Farming in the United States
(Answer Sheet continued)

c. Corn is grown mainly in the Midwestern States of the corn belt.
d. Wheat, both spring and winter, are grown in the north central states and in the Mideastern states.

4. The total value is approximately 24 billion dollars annually.

5. Total crop production must continue to increase to be able to meet the demand for food for the growing population of the United States. Some optimistic people have predicted that total food production will have to double by 1985 to meet the needs of our population which will exceed 5 billion.

6. The number of acres that can be farmed is decreasing. There are many reasons for this, but the one that is most frequently mentioned is that farmers misuse or mistreat their land and the land becomes so poor that nothing will grow on it unless extensive work is done to rebuild the soil and get it back into production. This cannot be done very easily now because of the costs involved.

7. It would be possible to convert about 1.5 billion acres of noncropland to productive crop acreage if land owners were willing to give up grazing land, increase irrigation in certain areas, and invest in the cost of land conversion.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Farming in Texas

1. $5,819,579,000
   Crop receipts - $2,848,000,000

2. $49,500,000,000

3. Services and supplies used by farmer exceeded $2,000,000,000.

4. a. Reports issued by Texas Agriculture Department
   b. Farm organizations
      1. Farm Bureau, etc.
   c. United States Department of Agriculture Crop Reporting Service
   d. Radio, TV, farm reporters
   e. Annual State Extension Service Reports
   f. Texas Almanac

5. There are 15.

6. There were 209,000 farms with an average size of 678 acres.

7. The major trend in the agriculture of Texas is an increase; not necessarily an increase in the number of farmers, but an increase in total production and an increase in capital to the farmers. This is due to many things, the many farmer-owned marketing cooperatives, many farm organizations, the general level of the nation's economy and last but not least, the Texas Department of Agriculture.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Introduction

TOPIC: Farm Organizations and Farm Service Agencies

1. The Farm Bureau, National Grange, and Farmer's Union

2. a. Farm Bureau - 1,500,000
   b. National Grange - 850,000
   c. Farmer's Union - 200,000

3. a. Marketing farm produce
   b. Purchasing supplies and services for its members

4. Market farm produce for its members

5. The Rural Electrification Administration (REA)

6. In most cases, they receive help or assistance as a group that they could not receive as individuals

7. 1862

8. Research, education, regulatory work, marketing, conservation, and agricultural adjustment

9. Nine

10. a. Secondary school
    b. Young farmers
    c. Adult farmers

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Records

TOPIC: Keeping Farm Records

1. The main reason for keeping farm records is to use them as a reference in making improvements and in adding or dropping enterprises.

2. Many small items bought by the farmer could be tax deductible if records were kept.

3. a. Not keeping records up to date
   b. Forgetting to record items

4. a. To determine if the operation is profitable
   b. Submit a tax report
   c. Improve production

5. a. Inventory
   b. Expense and income
   c. Loss
   d. Production
   e. Land use
   f. Business agreement

6. No. Farmers may use similar record books, but the method of keeping records is unique with each farmer.

7. Yes. Many farmers plant new varieties of crops; therefore, it is important to know the problems encountered in the production of the new varieties.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Records

TOPIC: Using Records in Farm Management

1. A farmer should select the kind of records by deciding what records will be of the most benefit to him in making improvements in his total farm program and help to answer any questions that might be asked by the Internal Revenue Service.

2. Some farmers are losing money on certain enterprises because they have a poor record keeping system that does not show profit and loss on each enterprise.

3. Maps not only help a farmer avoid getting into trouble with herbicides and loss of crops but also help him predict what his weed problem will be the following year. By being able to predict his weed problem, he can buy herbicides during the off-season and usually get some discount on the price. If the farmer has several fields, he may have grasses in one or two and broad leaf weeds in the others. If he applies herbicides to these fields and gets a little growth from some of the other weeds or grasses in the field that year, he can be relatively certain that the particular weed that was present the year before will again be present the following year. (This same thing will hold true for insect and disease problems, and these diseases call for prevention rather than control.)

4. A farmer's map and books can show the cost of everything that goes into a block of land, including levelling and squaring it up. He needs to know what he did, and how much labor and equipment time was needed to get a certain yield from a crop, on a cost per acre basis. Then by comparing this to a field or fields that have not been levelled, this farmer could determine whether or not levelling would be a sound management practice. If the farmer decides that it would be profitable, he can take his map and draw the way he wants his farm to look after it has been levelled. In this way he can make a long-range farm plan.

5. By keeping a record on maps of what crop and which variety was planted on each block of land, a farmer can determine the crop and variety that will yield the most on a particular block of land under his local conditions. In doing this, considerable experimenting must be done to find the best crop. But if it is done, net profits should increase.

UNIT: Farm Records
TOPIC: Using Records in Farm Management
(Answer Sheet continued)

A farmer can tell when a crop quits yielding on a certain block of land, and he can compare years and blocks and determine what rotations work the best for each block. The main thing to remember is that soil types will vary from block to block in most farming areas in Texas. Crop production depends to a large extent on the particular crop's response to fertilizer, water, etc. furnished by a particular type of soil. For this last reason, a great deal of experimenting must be done before a farmer can determine how to get the most from his land. Mapping is an easy tool that will help the farmer make these decisions based on what happened in the past, but the farmer must keep his maps up to date.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Machinery - Maintenance and Operation

TOPIC: Proper Use of Machinery and Equipment

1. Operating farm machinery can be very dangerous if operated improperly. In order to prevent serious accidents, the operator should follow safety rules at all times.

2. By being aware of conditions that could cause serious injury to the operator and eliminate these hazards

3. To get the most efficient use possible from the machines and to avoid injury to the operator and other people that may be close by

4. Over one-half of the farm accidents are caused by farm tractors. Several accidents are the results of climbing on a tractor with shoes that give improper footing. If the tractor platforms and pedals are greasy or covered with mud or ice, the footing is unsure and dangerous.

5. a. Improper use of electricity
   b. Use of agricultural chemicals
   c. Careless handling of livestock
   d. Leaving sharp edge tools where they were last used
   e. Fire hazards
   f. Standing in an improper position when lifting or carrying heavy objects
   g. Unprotected water tanks
   h. Vegetation and buildings obstructing view of intersections
   i. Working machinery while power is still in operation

6. Failure to use the protective features around moving parts

7. Most fatal accidents are caused by the tractor and tractor operated equipment.

8. a. The operator should be the only person riding the tractor.
   b. Brake the tractor properly.
   c. Stay a safe distance away from a ditch or creek bank.
   d. Hitch heavy loads in a position to cause traction.
   e. Avoid running over high objects or having a wheel fall in a hole.
   f. Be sure tractor is operated at a proper speed.

UNIT: Farm Machinery - Maintenance and Operation
TOPIC: Proper Use of Machinery and Equipment
(Answer Sheet continued)

g. Add weight to wheels on front end when pulling a heavy rear load up a steep grade.
h. Use proper support when removing wheels or working beneath tractor.
i. Use proper precaution signals and lights after dark, when operating on public roads.

9. a. When refueling tractor turn off all electrical switches.
b. Use painted fuel containers that have been authorized for fuel storage.
c. Do not smoke around fuels.
d. When using LP gas fill tank with vapor-return hose line.

10. a. Ladders, stairways, barn storage areas, loose materials stored overhead and boards containing nails.
b. Improper storage of flammable materials.
c. Failure to ground certain appliances and equipment.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Machinery - Maintenance and Operation

TOPIC: Maintenance of Power Machinery

1. By carefully servicing and operating the machinery and having regular maintenance check ups

2. Those repairs that can be made with basic mechanical skills and tools available to him on the farm

3. The cost of small tools, gauges, greases, oils, replacement parts, and service supplies

4. Records are not necessary if servicing is done at regular intervals and there is no chance of operating machinery past the recommended servicing times. But without records, this will be difficult to do because no farmer can remember everything about his farming operation every year. So, records are very important to the efficient operation of machinery and to the overall farm operation.

5. a. Check the engine oil level.
   b. Check the water level.
   c. Check the air filter oil level.
   d. Grease or lubricate fittings.
   e. Check fuel supply.
   f. Check belts.
   g. Check electrical system.

6. The tractor carburetor will use about 9,000 gallons of air for each gallon of gasoline. The air cleaner must remain clean.

7. The oil-type and dry-type

8. Oil oxidizes and becomes thicker. It flows less rapidly and may cause varnish deposits.

9. The failure to use a rust inhibitor and the coolant level too low

10. Certain places should be greased each day of use. Some tractor manufacturers suggest greasing the tractor after operating it a certain number of hours.

UNIT: Farm Machinery - Maintenance and Operation
TOPIC: Maintenance of Power Machinery
(Answer Sheet continued)

11. Diesel fuel and water are near the same weight; therefore, it takes time for the water to separate from the fuel.

12. Viscosity is the oil's ability to flow. A viscosity test is used to classify oils into certain standard grades.

13. a. The quality and grade
    b. The length of time the engine runs
    c. Starting and stopping the engine
    d. Running speed of engine
    e. The length of time the oil has been in the engine
    f. Type of work being done by engine

14. a. Underinflation - This condition permits the tire to fold and buckle.
    b. Failure to make adjustments when plowing in furrow
    c. High speed operation on low pressure
    d. Sidewall cracking due to overloading
    e. Overinflation - An overinflated tire is damaged if it hits solid objects with blunt edges.
    f. Tires are damaged by equipment, loose chains, holding stones, and towing equipment at high speeds.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Machinery - Maintenance and Operation

TOPIC: Maintenance of Equipment

1. The most important thing a farmer can do to increase the life of his equipment is to follow the manufacturer's guidelines for taking care of the equipment. By following the owner's manual, the life of the equipment will be increased and the repair costs will be decreased.

2. The farmer should make all repairs that he is capable of doing. But, if the farmer does not know how to make certain repairs, he will save time, money, and possibly more severe breakdowns by letting a qualified mechanic make the repairs.

3. The farmer can control his equipment maintenance costs by carrying out a regular maintenance and servicing schedule and by keeping accurate records of the servicing for each piece of machinery.

4. There is no specific time for greasing bearings on disc plows or other machinery. But in most instances bearings that are under constant, high speed pressure should be greased about every 6 to 10 hours of use. Other bearings should be greased regularly also, but at different intervals. Be sure to check the owner's manual for correct time to grease.

5. All types of farm machinery should be greased, wherever needed, on or before the time recommended in the owner's manual.

6. This is important because if one grease fitting is missing the entire piece of machinery may break down. So, it is very important that all parts needing lubrication are greased.

7. a. Lubricate bearings.
   b. Keep all parts tight by tightening nuts and bolts.
   c. Coat parts that are in contact with the soil with lubricant or old crankcase oil.
   d. Keep cutting edges sharp.
   e. Use paint to touch-up above ground parts.

8. a. Blades should be sharp at all times.
   b. Check safety device before putting machine in motion.

UNIT: Farm Machinery - Maintenance and Operation
TOPIC: Maintenance of Equipment
(Answer Sheet continued)

c. Mower should be running before entering vegetation area.
d. Avoid holes, rocks, stumps, and other obstructions.
e. Wheel bearings and gears should be well lubricated.

9. Keep the machine clean when not in use.

10. a. Operating the mower properly
    b. Keeping the mower well lubricated
    c. Maintaining sharp cutting knives

11. a. Teeth
    b. Stripper bars

12. The slides will be drier; thus, eliminating rust.

13. Cylinder knives

14. Combines are machines that work in chaffy, dusty, and even sandy conditions. Combines require several kinds of lubricants. Under sandy conditions, the combine chains may give longer service if they are not oiled.

15. a. Gathering unit
    b. Stripper rolls
    c. Operating speed
    d. Chain and belt tension
    e. Clean out doors and grills
    f. Safety clutch

16. The dealer's and owner's manual should be consulted on the operation, care, and repair of a cottonpicker.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Structures and Equipment

TOPIC: Maintenance of Farm Structures and Equipment

1. The enterprises on the farm and the purpose for which the man is farming

2. Masonry, frame or wood, concrete blocks, and tile

3. Farm equipment should be operated and maintained according to the manufacturer's directions.

4. To prevent wood and fabric parts from decaying and metal parts from rusting

5. Moisture from either rain, snow, soil, or dew combines with the oxygen in the air and forms iron oxide (rust) on metal parts made of iron or steel.

6. a. Fades paint and causes some paint to lose its protective qualities
   b. Dries out and cracks wood and some fabric materials
   c. The sun's rays may weaken rubber insulation, belts, and tires

7. Yes. Loose sand and gravel blown against buildings or equipment will remove paint and other protective covering.

8. a. No. No protection from ground moisture
   b. Moisture is "trapped" under the cover

9. a. Keep machines painted.
   b. Apply rust preventatives.
   c. Store in dry area under a cover.

10. a. Measure the equipment by length and width.
    b. Use a piece of cardboard showing the measurements and location of each piece of equipment. Use the name of the machine.
    c. Cut out each machine or equipment section and arrange these cut-outs on a sheet of paper to determine the size of the floor plan.

11. a. Rust and/or wood and fabric parts decaying
    b. Abuse during operation
    c. Out-of-date or outmoded when comparing to new equipment

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Farm Structures and Equipment

TOPIC: Building and Maintaining Farm Fences

1. Permanent and temporary

2. It takes almost as much time to plan a poorly-designed fence as to plan a well-designed fence. A well-designed fence usually has a longer life and it gives more efficient use of the land.

3. a. Make a sketch of the farm.
   b. Divide the land according to its capabilities to produce crops.
   c. All lanes and roads should be drawn on the fence plan.
   d. Show gates and entrances to buildings and fields.

4. a. Plan a fence around the entire farm.
   b. Plan a fence around permanent pastures.
   c. Plan a fence around permanent water holes.
   d. Plan a fence for all lanes and roads.

5. The woven wire fence has 10 line wires and is 47 inches high.

6. 3,000 to 4,500 pounds

7. By treating with a wood preservative

8. Approximately 100 feet

9. Three posts in one assembly. Two anchor posts, a brace post, and two cross braces form the assembly.

10. Posthole digger, tamper, axe, spade, saw, block and tackle, hammer, wire pliers, steel tape, level, gauge pole, and heavy cord

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Crop Selection

TOPIC: Important Factors Affecting the Choice of Crops

1. There are no crops of great importance grown in the United States that are native to this country. Most people think that corn is native to the United States, but it actually was brought into cultivation in the Tehuacan Valley, south of Mexico City. Other domesticated plants near Mexico City included beans and squash.

2. New cropc and improved crop varieties are made available to farmers through the efforts of plant geneticists and plant breeders. These specialists and technicians will work with a group of plants for many years before they develop a new strain that is resistant to a disease or adaptable to certain climatic conditions. Experimentation and research have produced crop varieties that are more productive, adaptable to machine harvest, and of higher quality.

3. a. Crop use and market
   b. Adaptable to climatic conditions
   c. Adaptable to soil conditions
   d. Labor, machinery, and equipment
   e. Available acreage
   f. Resistance to insects and diseases
   g. Length of time to mature
   h. Quality of the product
   i. Quantity of the product
   j. Cost of production

4. a. To improve existing varieties of plants
   b. To develop new varieties of plants

5. a. To produce a maximum yield
   b. To supply the market demand
   c. To bring an adequate net return to the producer
   d. To produce a product without experiencing major problems

6. Prehistoric times. Wild plants used as food for man were domesticated by bringing the plants into cultivation.

UNIT: Crop Selection
TOPIC: Important Factors Affecting the Choice of Crops
(Answer Sheet continued)

7. Plant selection is the selection of plants with favorable or desirable characteristics and eliminating undesirable ones.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Importance of a Good Seedbed

1. To give the plant the best possible start in life

2. A seedbed is the soil in which the seed is placed to get started as a new plant.

3. A firm seedbed keeps the seed in closer contact with the soil and usually results in a better germination which gives a better stand.

4. The top portion of a seedbed should be loose and mellow to allow plenty of air circulation in the soil so the seed will germinate more quickly and the seedling will grow through the loose topsoil more readily. This loose topsoil will also keep the rest of the seedbed from drying out as quickly as it would if the seedbed was firm.

5. The bottom portion of the seedbed should be finely pulverized so the seed will make good soil contact and the roots will penetrate easily. This portion of the seedbed should be fairly firm so moisture will be held in the soil and thus enable the seedling to become well established.

6. A fertile seedbed is very important to get a rapid growing healthy seedling. Any seedling that is rapidly growing and healthy will stand a better chance of making a mature plant than one that is slow growing or unhealthy. Another very good reason for keeping fertility levels high is that plants will make more efficient use of available moisture. In many parts of Texas, inadequate moisture for crop gorwth is probably the greatest problem that exists.

7. a. Finely pulverized
   b. Firm
   c. Loose and mellow
   d. Free of trash
   e. Free of growing vegetation
   f. Fertile
   g. Free of insects
   h. Free of diseases

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Row Crop Seedbed Preparation

1. Crop residue makes cultivation difficult if it remains on the soil. The soil needs the organic matter put back into it for it to remain productive, and often crop residue will be a host for overwintering insects and diseases.

2. Each piece of equipment has a specific job to do and it should be used to do that job.

3. Primary tillage is the first tillage that is done following the harvest of the previous crop. It is important because the soil will become packed during the growing season of the previous crop, and unless the soil is plowed deeply, the soil will not hold much moisture, the crop residue will not be put back into the soil, and the soil will not contain enough air spaces for the roots of the next crop to grow.

4. A good seedbed is important because, for farming to be profitable, a high yielding crop must be planted. All that is planted must germinate, grow, and be harvested for a crop to be profitable. If the seeds do not grow out of the soil, and the soil will not let them grow to maturity, no crop will be profitable.

5. They are: The soil must be finely pulverized, firm, but loose and mellow, and free of trash and weeds.

6. The lister or moldboard plow

7. To plant crops in rows

8. Any method that is currently being used in preparing a seedbed could be considered modern, but the methods that result in the seedbed having the characteristics of a good seedbed are "the" modern methods of seedbed preparation, and this is the reason that they are being used.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Broadcast Crop Seedbed Preparation

1. This will vary considerably depending on the soil type, but generally a fairly fine top two inches of soil over a firm but open soil layer will insure good penetration and conservation of moisture. A few small clods should remain in the surface soil, though, so the rainfall will be less likely to puddle and make the soil crusty.

2. Weed control is extremely important to the culture of any crop but especially to small grains. This is true because weeds compete for moisture and are also hosts to many of the diseases of small grains.

3. Wind and water erosion are very important to the small grain farmer because he plants his fields flat. In flat fields there is little resistance to the wind or water, and the soil will be more easily moved by either wind or water. Every farmer is concerned with the loss of topsoil. Estimates show one million years is required to form one inch of topsoil, so every effort is made to avoid erosion.

4. Large amounts of undecomposed organic matter left in the area where the seed is to be placed is undesirable for several reasons. The first being that the dry organic matter will hold a lot of moisture the seed needs in order to sprout. Secondly, this may prevent the planted seed from having enough contact with the soil for it to sprout. Finally, the decomposing organic matter will use nutrients in the soil and make them unavailable to the young seedling.

   All in all, undecomposed or decomposed organic matter will more than likely reduce the stand of small grains in an area, and depending on the amount of straw and stubble, may severely diminish the yield.

5. Small grains should be planted one to two inches deep so they can sprout easily and have enough moisture in the soil to become firmly established. The seed should be placed on top of a firm, moist area and then covered with loose soil.

6. These types of plows are used only for row crop planting.

7. The moldboard plow fails to leave a protective stubble cover. The stubble is turned under, leaving the soil bare.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Permanent Pasture Preparation

1. For the same reasons that row crops need land preparation, to provide an ideal place for root development media.

2. Some plants need the residue of previous crops for protection from wind and beating rains.

3. Some of the factors to be considered before starting an improved pasture would be:

   a. Can this amount of land be diverted for 5 years and not cost more money than its worth?
   b. What type of grass is needed?
   c. Will it grow under local conditions?
   d. What kind and how much land preparation will be needed?
   e. What time of year should the grass be planted or sprigged?

   Each of these questions may require 15 or 20 pages to discuss adequately, but if they are thought through, a farmer can usually come up with a long range plan that will be favorable for establishing a permanent pasture.

4. The main thing that has to be considered is the local condition. Many things are involved in this. They are:

   a. Topography of the land
   b. Amount of rainfall expected
   c. Type of vegetation already growing
   d. Soil type and soil structure
   e. Whether or not land can be irrigated
   f. What use is to be made of the grass after is is established

   Topography of the land includes the lay of the land, is it flat or hilly, is it washed out or smooth, or any number of conditions that exist in Texas. The amount of rainfall expected would determine how much clearing that would be necessary. If there is a shortage of moisture, extensive weed and brush control should be carried out, but if there is plenty of moisture available, only a minimum amount of brush control would be necessary. In nearly all cases, a sound weed control program should be practiced.

UNIT: Land Preparation
TOPIC: Permanent Pasture Preparation
(Answer Sheet continued)

The type of vegetation growing in an area would also affect the amount of land preparation necessary. For example, some plants produce a poison in their roots that will keep other plants from growing around them. Some plants, including many trees, have roots that are very close to the top of the ground and these plants will use the available moisture in the top 12 inches of the soil very rapidly. There are many other plants that will not compete favorably with the grass to be established. Whenever these situations exist, all plants that will not compete favorably with the grass should be eliminated. Always keep in mind that grazing cattle or livestock need some shade, and many trees will compete favorably with established grasses.

The type of soil also will affect the amount of land preparation needed. If there is very little topsoil, it would be difficult to plow the entire area, but if the soil is deep, it would probably be beneficial to plow the entire area. On the other hand plowing a loose, sandy loam may be an unnecessary expense, but a tight clay soil would require plowing in order to loosen the soil so the grass roots could penetrate. Again it is difficult to say how much land preparation is necessary because all sorts of situations exist between the two extremes mentioned.

If the land is to be irrigated, what type of irrigation is to be used? Flooding may be cheapest. In this case, the land will have to be leveled and cleared completely. If sprinklers are to be used, the land wouldn't necessarily have to be leveled but it should still be cleared. The main things to consider are the opposing costs of the different types of irrigations systems and the evaporation rate of the locality.

Another point to consider is the expected use of the grass after it is established. This is more an academic consideration but if there is a possibility of baling the grass, the entire area should be more or less accessible. This would involve clearing brush and filling in rough places such as washes. In particular situations this may be desirable anyway.

Go back and read question four again. There is no easy answer to this question because there will never be an instance where any of the factors mentioned, except maybe the last one, will not depend on some of the others, and they will all depend on the climate. So to actually determine the amount of land preparation needed, the best balance of conditions that will yield the most desirable situation for a farmer in his locality should be determined and then followed.

The main thing to remember is that shortcuts in preparing a permanent pasture

UNIT: Land Preparation
TOPIC: Permanent Pasture Preparation
(Answer Sheet continued)

may result in cutting short the grass available and will probably cost the farmer rather than make him some money.

5. a. The soil, climate, returns from grazing, and hay produced
   b. Plants that will produce the quantity and quality of forage needed

6. a. Clear land of trees and brush.
   b. Break land early to allow it to settle before planting.
   c. Disk lightly before planting.
   d. Sow seed so that it will be in contact with soil moisture.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Land Preparation

TOPIC: Land Management Practices (Leveling of Land, Drainage, and Erosion)

1. Increases the soil temperature in early spring, increases the mineralization rate making nitrogen available, allows early planting, and permits more soil use

2. Alkali or saline soils are reclaimed by lowering the water table and irrigating with water relatively free of salts.

3. Improves soil structure and causes soils to be more productive

4. Humid regions usually require more drainage than arid regions.

5. a. Provides a deeper root zone
   b. Provides oxygen or air for root development
   c. Provides a good environment for the growth of soil bacteria
   d. Regulates soil temperature so that it is more favorable for plant growth
   e. Removes soil salts from the plant media
   f. Permits water to enter the soil, thus reducing soil erosion
   g. Extends the crop growing season
   h. Improves soil conditions for early plowing and planting

6. a. Water seeping from reservoirs and lakes
   b. Overflow of rivers and other streams
   c. Flow of water from high areas to low lands
   d. Subsoil lacking permeability characteristics
   e. Topography of the land fails to permit water to move out of low areas.

7. a. Open ditches - Open ditches are used to collect and carry off surface and subsurface water. Ditches may be lined or unlined.
   b. Tube drainage - This type of drainage collects subsurface water. Plastic, concrete, and clay tubing are used.

8. Intercepting ditches or drains

9. Use a good cropping system by maintaining a vegetative cover to slow run-off on slopes and improve the infiltration of run-off water into the soil.

UNIT: Land Preparation
TOPIC: Land Management Practices
(Answer Sheet continued)

10. a. Corn - Irrigate to a depth of at least 3 feet. The furrow method is considered the most desirable.
    b. Cotton - As in corn and other crops, soil type affects the amount of water needed. The available soil water should be in the second and third foot of the soil. As the water increases in this zone at the proper time, the amount of lint increases.
    c. Sorghums - Grain sorghums like cotton will produce in areas where the rainfall is between 15 and 25 inches; that is, if the rainfall is at the proper time. It obtains most of the water (plant use) in the first 2 to 3 feet of soil. In irrigated areas the soil is wet to about 5 feet.
    d. Rice - After rice is sown and fertilized, the land is flooded to speed up germination, and as the plant grows the water is usually raised to a depth of 6 inches, but never covering the entire plant.
    e. Wheat - Wheat should be planted when the soil is moist at least 2 to 3 feet deep. Wheat is usually not irrigated and it is planted in many areas with one foot of moisture.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Introduction

1. In 1842
2. 1850
3. Baltimore, Maryland
4. 22,097,000 tons
5. In South Carolina in 1868
6. Waste products from other industries
7. East North and West North Central states
8. Edmond Ruffin of Virginia
9. Justus Von Liebig
10. They are necessary to:
    a. Make plants grow better
    b. Help build up and conserve the soil
    c. Make farming more profitable
    d. Make farmers more prosperous
11. Production of superphosphate
12. To protect consumer and manufacturer from dishonest manufacturers

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Plant Nutrients and Their Functions

1. Nitrogen, phosphorus, potash, calcium, magnesium, sulphur, and the micro-nutrients.

2. Nitrogen, Phosphorus, Potash

3. a. Gives dark green color to corn
   b. Induces rapid growth
   c. Increases yields of fruit, seed, or leaf
   d. Leaf crops quality will be improved.
   e. Protein content of grain will be increased.

4. Leaves will turn reddish-purple

5. Firing or drying along the tips and edges of lower leaves

6. Potassium

7. Calcium

8. Secondary plant nutrients

9. Micro plant nutrients

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Types of Fertilizers (Advantages and Disadvantages of Each)

1. Liquid, dry, gaseous

2. Natural gas

3. To build up the organic matter content of the soil, reduce soil and water losses and influence the chemical properties of the soil

4. a. Adds high quality organic material
   b. Green legumes add a good supply of nitrogen to that which comes from the soil.
   c. Improve the overall soil physical condition

5. A complete fertilizer contains the three major elements: nitrogen, phosphoric acid, and potash.

6. Ammoniation is the adding of a certain amount of anhydrous liquid ammonia or ammonia solution to an exact amount of known fertilizer mixture.

7. There are 260 pounds each of the three major elements in 13-13-13.

8. Fish feed on microscopic animals, insects, and fish. The microscropic animals are more plentiful if there are adequate water plants for them to feed upon.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Applying Fertilizers

1. By using fertilizers properly

2. a. Broadcast before planting
   b. Drilled into row at time of planting
   c. Adding nutrients to irrigation water
   d. Spraying onto foliage
   e. Sidedressing after crop is up
   f. Topdressing close growing crops
   g. Depositing gaseous nutrients

3. To get the maximum benefit and use of materials

4. To be able to select equipment that will best meet the needs of the crop farmer

5. a. Soil type
   b. Climatic conditions
   c. Fertilizer

6. Row, broadcast, spin broadcast, and grain drill

7. a. Anhydrous ammonia
   b. Phosphoric acid
   c. Potash

8. a. Bottom dressing
   b. Side dressing

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Fertilizers

TOPIC: Soil Types and Fertilizer Use

1. Yes. The pH affects the availability of plant food nutrients. Also soils high in organic matter and good physical condition react favorable to fertilizers.

2. Mineral matter, organic matter

3. a. Sand
   b. Silt
   c. Clay

4. By the amount of sand, silt, and clay found in the soil

5. Soil particles with mostly hydrogen ions test acid and particles with mostly basic ions (Ca, Na, K) test basic.

6. Because it is the best method available to determine levels of fertility in the soil and for the farmer to know how much fertilizer to put in the soil to meet his crop's requirements

7. a. 43-85%, 0-50%, and 0-20%
   b. 20-45%, 15-53%, and 27-40%
   c. 85-100%, 0-15%, and 0-10%
   d. 0-45%, 0-40%, and 40-100%

8. a. Fine soil - Long pliable ribbon forms from a ball of moist soil.
   b. Medium soil - No ribbon is formed. The soil is smooth and gritty.
   c. Coarse soil - Soil crumbles easily, feels gritty and lacks smoothness.

9. These plant nutrients are available at a wide pH range, but the most optimum range is between 6.0 and 8.0.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Irrigation

TOPIC: Importance of Irrigation

1. Irrigation is as old as civilization. Irrigation made civilization possible, as we know it. Irrigation was practiced before the writing of history began.

2. Irrigation was practiced on the Nile River in Egypt more than 3,000 years B.C. and in China more than 4,000 years ago. Tu-Kiang Dam, still being used, was built in 200 B.C. Irrigation was practiced in America by the Indian, long before the white man arrived here.

3. a. Cotton - 18
   b. Small grain - 18
   c. Corn - 20
   d. Pasture - 36
   e. Vegetables - 16
   f. Fruit - 30

4. Irrigation is a method of supplying a plant a continuous supply of water so that the plant will grow its maximum amount from the time the seed sprouts until the plant is ready for harvest.

5. The principal methods of irrigating are:
   (a) Sprinklers
   (b) Gravity flow

6. Some soil factors that are important in getting the maximum benefit from irrigation are:
   (a) Soil texture
   (b) Soil structure
   (c) Soil depth
   (d) Layering

7. There are two main methods of irrigating: (1) by sprinklers and (2) by gravity. Gravity irrigation is running water down the row or by filling between borders. The water, if applied by sprinklers or by filling borders, will move downward in the soil and move both down and out. This movement

UNIT: Irrigation
TOPIC: Importance of Irrigation
(Answer Sheet continued)

depends mainly on the texture of the soil and the slope of the land.

8. If the soil has a good moderate texture, is deep, and is over a rock base, the plant's root penetration will be good, and the plant will suffer very little from moisture stress, until the soil dries out fairly deep. On the other hand, if the soil is fine textured and shallow with a dense clay subsoil, the plant root will not penetrate very deep and the soil at the depth of the root will dry out very rapidly. Therefore, more frequent irrigation may be needed.

   In addition, some crops have a deeper root system and usually these crops require less frequent irrigation for the same reasons that soil structure and layering affect the frequency of irrigation.

9. An acre inch of water is a volume containing 3630 cubic feet. It will cover one acre one inch deep. An acre foot of water is equal to 43,560 cubic feet and will cover one acre one foot deep.

   Water flowing at the rate of one cubic foot per second equals approximately 450 gallons per minute. It will take one hour to cover an acre one inch deep at this rate of water flow.

10. Irrigated cotton farms had a 493 percent higher labor income.

11. Take samples of soil from the depth of one foot and squeeze them in the palm of the hand. If the loam soil forms a stable ball, it is not necessary to irrigate; however, if it crumbles, the soil needs water.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Irrigation

TOPIC: Sources of Water and Principal Methods of Irrigation

1. Many things must be considered before deciding upon a certain type of irrigation, among them are:
   a. Source of water and its availability
   b. Quality of water
   c. Nature and type of soil
   d. Crop to be irrigated
   e. Cost of installation, operation
   f. Experience of farm operator
   g. Amount of rainfall and distribution
   h. Climatic conditions

2. The main sources of irrigation water are surface and wells.

3. a. Soils with high intake rates
   b. Fields with irregular topography
   c. Soils too shallow to level
   d. More even distribution of water coverage

4. Side-roll lateral system that is self-propelled

5. Close-growing crops and row crops

6. Drilled and sown crops and sod crops

7. a. Levees constructed on the contour to control the water movement and depth
   b. Contour ditches are formed on the contour to release water to lateral ditches

8. Approximately one percent

9. Furrows break on contour row farming, causing heavy row damage in light sandy soils.

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Answer Sheet continued)

10. Water is applied in small channels across the field. It is used in arid or low rainfall regions on fairly level soil.

11. a. Used as a drainage system if necessary
    b. Water moves both horizontally and vertically below the crop's roots.
    c. Barrier against loss by percolation
    d. Used for soils with low water holding capacity

12. The main sources of water supply are deep wells and ground water. Water is also supplied by lakes, reservoirs, and canals.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Irrigation

TOPIC: Irrigation Management

1. Land preparation is very important in irrigation, because the land must be level in order to get a good coverage of all the land.

2. The divisions of irrigation are delivery, application, and control of tail water.

3. Good irrigation water is water that is very low in harmful salt content and does not contain obnoxious weed seed.

4. El Paso and Hudspeth counties, located in the extreme western part of the state, have an annual rainfall average of 8 inches. An area made up of the eastern part of Jefferson and Orange counties has an annual rainfall average of 58 inches.

5. a. Boot, bloom and milk dough stages
   b. Bloom and boll maturing stages
   c. Tasseling-silk stage
   d. Prior to and during time nuts start to form
   e. Seed head formation
   f. Head formation and filling
   g. Fruit setting and enlargement stages

6. Fifteen to 26 inches of water

7. To maintain a continuous supply of available moisture in the soils plant food zone throughout the growing season

8. Squeeze soil sample in palm of hand, and if a ball is formed, there is adequate moisture.

9. Prior to planting

10. In the top 40 percent of the root zone

11. Interest, taxes, insurance, and depreciation

12. Approximately 25, 14, and 9 respectively

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Weed Control

TOPIC: Importance of Weed Control

1. A weed is any unwanted plant, or a plant out of place.

2. Herbicides can be very injurious. They have caused death to men working with them. They have caused losses among livestock and crops because of ignorance and carelessness in using them.

3. Weeds can cause the value of land to decrease. Weeds can be hosts to insects while the insect spends the winter there or goes through certain stages of its life cycle.

4. Weeds can cause a direct loss to the farmer in many ways, but the main ones are:

   a. Weeds will reduce crop yield from moisture competition and
   b. The presence of weed seed in crops will lower the value of the crop.

5. H. B. 402 is the first herbicide law passed in Texas that regulates the sale and use of hormone type herbicides in almost all Texas counties where row crops are grown. Since this law was passed, many changes have been made in it and there are likely to be more in the future.

6. The counties are affected in the following ways:

   a. Regulated by the H. B. 402
   b. Need no permit for January and February
   c. Exempted only by Commissioner's Court ruling
   d. Entirely exempted

7. Any person applying hormone-type herbicides by standard methods of application

8. Environmental Protection Agency

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Weed Control

TOPIC: Classification and Identification of Weeds

1. According to life span, weeds are classified as annuals, weeds completing life cycle from seed each year; biennials, weeds taking two years to complete life cycle from seed; and perennials, weeds taking three or more years to complete their life cycle. Perennials may reproduce sexually or asexually.

2. Weeds are spread by wind, animals, and man. Some seeds drift or float for great distances even without wind.

3. The farmer who can tell the difference between annual and perennial type weeds will be ahead of others in his weed control program. For example, an annual weed can be killed in one year if the plant is not allowed to go to seed. Annuals can be eliminated simply by mowing or plowing, whereas, perennials will grow back each year from the old root system, so it is difficult to "kill out" perennial weeds by mowing or plowing. A farmer can, by knowing what his weed problems are going to be next year, buy his herbicide at the time of year it is the cheapest and thus reduce his cost. But, if the farmer has a mower or shedder he may be able to get rid of most of his weeds by simply mowing and not be out the cost of herbicides.

4. If a farmer knows by what means a particular weed will be spread, he can, through management, keep the problem from getting larger. If a farmer has a severe johnson grass problem in a small grain field, and he combines the grain, chances are real good that most of the johnson grass seed will be harvested with the small grain. This grain should be sold or if the farmer chooses to feed it, he should grind it first. The next year he should buy certified seed.

   This procedure will not eliminate the johnson grass but it will keep the "weed" from spreading to other fields and pastures. Machinery, wind, etc. carry weeds, and by predicting and observing the direction of wind, spread of a weed can be predicted, and the weed can be killed when sprouting and before a root system develops.

UNIT: Weed Control
TOPIC: Classification and Identification of Weeds
(Answer Sheet continued)

5. A farmer must know the leaf structure of the weeds to be killed before he can know the type of herbicide to buy. The hormone type herbicides will "kill" broadleaf plants only, and other specialized herbicides are required to "kill" the weedy grasses.

6. The best way to control weeds and weedy type grasses is to keep them from getting started. If they have started, the farmer should plow, mow, or spray while the weeds are very young and never allow them to become established. The spread of weeds on a farm can be prevented by good management and accurate prediction. Management involves keeping borders of fields clean and free of weeds and avoiding the spread of weed seed in crop seed. There are many other ways that management can prevent the spread of weeds on a farm. Prediction involves observing weed growth and weather conditions, especially wind, thereby knowing where to look for new weeds next year and removing the sprouts as soon as they appear.

   Every year weeds and weedy grasses cost Texas farmers more than any one disease or insect. This cost may be derived from one or all of the following: herbicides, robbing the crop of necessary moisture and nutriments, or by lowering the quality of the crop. It is very important for farmers to control weeds, the best way being to never let them get started.

7. Primary and secondary noxious weeds

8. By machinery moving from field to field and by harvesting weed seed in the crop

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Weed Control

TOPIC: Control by Mechanical Methods

1. a. Mowing or shredding
   b. By cultivation
   c. By heat control method
   d. By smothering

2. How the weed reproduces and spreads, how it will react to environmental changes, and how they are adapted to different habitats

3. Before any weed can be destroyed, permanently, the plant must be prevented from reproducing. This is basic to any weed control program, and before this can be done the weeds must be identified and the method of reproduction must be known before it can be stopped.

4. a. Uprooting the weed in the seedling stage
   b. Covering the seedling with soil
   c. Cutting the weed's roots below the surface of the soil
   d. Cultivating the soil when the weed seed were germinating
   e. Plowing the soil very deep to destroy perennials

5. Weeds can be destroyed on all sides of the plant.

6. a. Surface cultivator - Blades or knives cut through the soil surface without stirring below 2 inches deep.
   b. Disk cultivator - Used to cultivate listed crops. Disks cut weeds and move soil into the furrow to bury weeds.

7. Cultivation

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Weed Control

TOPIC: Chemical Methods for Control

1. Safety should be stressed very strongly in the use of chemicals.

2. The following factors should be considered in using chemicals to control weeds:
   a. Stage of weed growth
   b. Soil conditions
   c. Rainfall
   d. Temperature
   e. Humidity

3. The use of herbicides does not eliminate the need for tillage, but only reduces the amount needed.

4. Each herbicide will vary regarding the ease of application, as well as the effectiveness of weed control. Some herbicides will damage all plants; some are selective. Before applying, read the label on the herbicide and follow the directions for preventing injury to crops.

5. Chemicals may be applied at four times and they are:
   a. Fumigation before seed is planted
   b. Pre-emergence - after the crop is planted but before it sprouts
   c. Emergence - applying herbicide just as the crop is breaking the ground
   d. Post-emergence - applying herbicide after crop has grown above the surface of the soil

6. The three main methods of applying herbicides are:
   a. Broadcast treatment
   b. Row or band treatment
   c. Spot treatment

7. The three main types of herbicides are:
   a. Liquid
   b. Granular
   c. Gas

8. The spray may become incompatible.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Answer Sheet continued)

9. Contact weed killers are not translocated in the plant's system.

10. Effectiveness of weed killers is determined by:
    a. Stage of weed growth
    b. Soil conditions
    c. Rainfall
    d. Temperature
    e. Humidity

11. Parts of a spray system are:
    a. Pump
    b. Supply tank
    c. Pressure regulators
    d. Valves
    e. Pressure gauges
    f. Strainers
    g. Spray booms
    h. Noses and fittings
    i. Nozzle

12. Types of sprayers are:
    a. Knapsack
    b. Multiple purpose
    c. Hand propelled
    d. Tractor mounted sprayers
    e. Fumigant injectors

13. Safety measures help protect the operator, avoid crop injury, and prevent harmful residues in food and feed crops.

14. Proper calibration will accurately discharge the required volume of spray per acre.

15. The practices are:
    a. Determine tractor ground speed.
    b. Select a nozzle or nozzles to meet spray discharge requirements based on tractor speed, gallons per acre, and nozzle spacing.
    c. Collect a measured volume of spray in a specific time period.
    d. Prepare tank mix based on active ingredients, rate per acre and gallons of spray per acre.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Insect and Pest Control

TOPIC: Safety

1. Environmental Protection Agency (EPA)

2. The sale, distribution, and transportation of pesticides are controlled through registration.

3. From one of the pesticide control centers in the state

4. By storing in original containers with the label attached and the lid closed tightly. Different types of pesticides should be stored in different locations. For example, insecticides should not be stored with herbicides.

5.
   a. Oral - The toxic material can enter the body through the mouth where it later passes to the digestive system.
   b. Dermal - Pesticide toxic material may enter the body through the skin. This method of body entry can be more dangerous than the oral method.

6.
   a. Insecticides - Prevent, repel, or destroy insects affecting humans, animals, plants, and plant material
   b. Herbicides - Prevent, repel, or destroy weeds and some other plants
   c. Fungicides - Prevent, repel, or destroy fungi
   d. Rodenticides - Control rats, mice, gophers, and several other harmful rodents

7.
   a. Goggles
   b. Gloves
   c. Aprons
   d. Boots
   e. Respirators

8.
   a. Organophosphates
   b. Carbamates
   c. Chlorinated hydrocarbons

9. By making a small border around the area and applying an absorbent material (lime and sawdust). After the pesticide is picked up it should be buried at least 18 inches deep in the soil.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Insect and Pest Control

TOPIC: Definition and Classification of an Insect

1. Insects destroy 12% of our farm production

2. An insect is a small boneless animal whose body is divided into three sections--the head, thorax, and abdomen. It has one pair of antennae on the head, three pairs of legs and often wings on the thorax, and as many as eleven segments, but no legs on the abdomen.

3. a. Head
   b. Thorax
   c. Abdomen

4. a. According to the way they feed on plants
   b. As harmful or beneficial
   c. By order

5. Chewing insects bite off, chew, and swallow plant parts.

6. Sucking insects rasp or pierce the outer layer of the plant and suck sap from the plant.

7. a. Improve the soil
   b. Pollinate plants
   c. Destroy harmful insects

8. a. Lady beetles
   b. Ground beetles
   c. Aphid lions
   d. Spiders

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Insect and Pest Control

TOPIC: Management

1. Killing, repelling, and interfering with the feeding and propagation of insects.
2. Natural and artificial
3. Artificial
4. By checking for insect damage
5. $704 million
6. 50 to 75 percent
7. Extension Entomologists, Agricultural Extension Service, College Station, Texas 77843

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Insect and Pest Control

TOPIC: Insecticides

1. Pesticides are poisonous chemicals used to kill pests, either plant or animal.

2. Insecticides are poisons used to kill insects.

3. Two major methods of classifying insecticides are:
   a. How the insecticide enters the insect's body
   b. The chemical nature of the insecticide

4. Three groups of insecticides based on how the insecticide enters the insect's body are:
   a. Stomach poisons
   b. Contact poisons
   c. Fumigants

5. Three groups of insecticides based on the chemical nature of the insecticide are:
   a. Inorganic poisons
   b. Organic compounds derived from plants
   c. Synthetic organic compounds

6. Eight major methods of formulating insecticides are:
   a. Dusts
   b. Granular formulations
   c. Insecticide-fertilizer mixtures
   d. Wettable powders
   e. Solutions
   f. Emulsifiable concentrates
   g. Aerosols
   h. Fumigants

7. Four basic principles to follow in an insect control program are:
   a. Scout or survey the crop frequently to determine the extent of insect infestations.
   b. Identify insects that need to be controlled.
   c. Rely on cultural and natural control when feasible.
   d. If economically advisable, use chemical control methods.

UNIT: Insect and Pest Control
TOPIC: Insecticides
(Answer Sheet continued)

8. Three basic principles of selecting, mixing, and applying insecticides are:
   a. Select an insecticide that is effective against the insect or insects to be controlled.
   b. Carefully follow directions on container in mixing and handling the insecticide.
   c. Apply the insecticide at the right time, at the proper rate, and in the correct form to gain maximum effectiveness.

9. Insecticides may be applied by:
   a. Ground machine
   b. Airplanes

10. Four things which determine the amount of insecticide applied per acre are:
    a. Nozzle size
    b. Number of nozzles
    c. Ground speed
    d. Pressure

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Diseases and Control

TOPIC: Definition, Classification of Diseases by Pathogens

1. A plant disease is a condition in which any part of a living plant is abnormal or which interferes with the normal activity of the plant's cells or organs.

2. Plant diseases are caused by pathogens, fungi, bacteria, nematodes, and viruses.

3. The visible effects of a plant disease are called symptoms.

4. Fungi are microscopic, multicelled plants that contain no chlorophyll and depend entirely on the host for food.

5. Fungi reproduce both sexually and asexually. Normally fungi will reproduce several times during a growing season, if weather conditions are favorable. Favorable weather conditions mean high temperatures, high humidity and morning dews. The fungi will produce asexual spores during the growing season, and these spores usually need a water environment in which to sprout. This is why the heavy dews aid the spread of a fungus. The sexual spores are produced toward the end of the growing season and will overwinter on the plant or in the soil. These spores are produced by mating two strands of fungi to form a spore.

6. Only those fungi which are plant pathogens are economically important to a farmer.

7. Some common examples of fungi diseases on farm crops are: powdery or downy mildew on grain sorghums, damping off or sore skin in cotton, and stem and leaf rusts on small grains.

8. Fungus spores may overwinter any place that will keep them out of direct contact with the weather; for example, old crop residue in the soil, or just plain soil.

9. Bacteria are one celled plants that have a cell wall and are totally parasitic. Most bacteria that are plant parasites are rod-shaped.

UNIT: Diseases and Control
TOPIC: Definition, Classification of Diseases by Pathogens
(Answer Sheet continued)

10. Bacteria reproduce by dividing or by "fission". A single bacterium, under favorable conditions may produce over 47 billion bacteria during a twelve-hour period.

11. Bacterial diseases are spread in many ways - by wind, water, equipment, and man. The bacteria can be carried from field to field on equipment, birds, etc., but the bacteria cannot cause a disease unless they can get into the plant. Unlike the fungi, which can penetrate a leaf, the bacteria can only enter the plant through open wounds on the plant.

12. Bacterial diseases are very common in field crops, but farmers do very little about them. In the future they will become more prevalent, and the damage will be more extensive. Two important examples of bacterial diseases today are anthracnose in grain sorghum and black arm in cotton.

13. Nematodes are small worms present in almost everything in nature. Nematodes range in length from 1/16 of an inch to 10 to 15 feet long. All nematodes are not parasitic, and the one characteristic that distinguishes a plant parasitic nematode from a non-parasitic nematode is the presence of a tiny spear on the head. This spear can usually be seen under a strong magnifying glass or a microscope.

14. Damage caused by all types of nematodes will almost universally result in a reduced vigor of the plants. A loss of a stand may be a direct result of nematodes or an indirect one because the plant in its weakened condition is more susceptible to other diseases.

15. Nematodes are spread by plowing, by water, and by man. Since nematodes live in the soil, they cannot travel more than an inch or two in a year, but when a plow is pulled through nematode-infested soil, the dirt is moved a foot or two down the row, thus making the spread of nematodes greater. Nematodes will also wash down a row from irrigation or from rain if the water is moving. Man, however, causes the greatest spread of the nematodes because he will carry dirt and clods from one field to the other on his equipment and the cleats of tractor tires.

16. A virus is a non-living, disease-producing agent that can only reproduce inside a living cell. An individual virus is so small that it cannot be seen under a

UNIT: Diseases and Control
TOPIC: Definition, Classification of Diseases by Pathogens
(Answer Sheet continued)

microscope, but its shadow can be seen if the virus is magnified around 40,000 times. One can readily see that the virus is very small, but it can cause very severe damage.

17. Viruses spread by several methods, but the most common are: insects, nematodes, seed, and man. All of these except seed carry virus from one plant to another and cause some type of injury to the plant. A virus cannot enter a plant unless the plant has been punctured, and each of the methods mentioned can cause injury to a plant and can spread virus.

    Seed from an infected plant will have the virus in them, and if this seed is planted, there is a strong likelihood of having a more severe outbreak of the disease condition in a crop.

    Viruses are controlled by using resistant varieties, sanitation, and seed treatment. If a regular field crop is planted, there is little chance of any economical control for viruses. However, high value crops, such as vegetables, may justify expense for virus control.

18. Viruses overwinter in dead plant cells or in the seed. They will not multiply, but they will live and can then be spread to other plants.

19. Viruses usually cause a mottled yellow or green effect. This mottling may be irregular, regular, or in lines. The one most familiar to farmers is probably tobacco mosaic virus on cotton.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Diseases and Control

TOPIC: Principles of Plant Disease Control

1. In order to have a diseased plant we have to have a susceptible host, a casual pathogen, and the environment must be favorable for the initiation of infection and establishment of the pathogen on or within the host.

2. The environment is one of the keystones of the disease triangle and directly influences both the host and the pathogen. If the environment can be made unfavorable to the host or the pathogen, a disease will not occur. Man can manipulate environment.

3. There are only certain times in the life cycle that a spray will prevent a disease from becoming attached to a plant. If the farmer knows when this time will occur, he can get a more efficient use of the spray by applying it at this time. If weeds are to be removed, the farmer should have a complete knowledge of the disease cycle as he will know what weeds to destroy at what time of the year.

4. It is necessary to prevent a disease because once the disease condition exists in a plant, it cannot be removed and the plant will become more diseased.

5. It is important to eradicate weeds in and around a field for two reasons:
    1. The weeds may serve as an alternate host for a disease, and the disease may spread from the weeds in the borders into the field.
    2. Weeds act as hosts for insects and many plant diseases in field crops result from insects carrying the disease from weeds to the crops.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Diseases and Control

TOPIC: Chemical Control

1. Plants were domesticated and improved to serve man. We must make each acre produce to its utmost capacity. A plant cannot do this if it is diseased; therefore, we must control plant diseases.

2. Since the earliest of recorded times, one of man's most persistent problems has been his search for food.

3. In 1967, conventional agriculture provided ample food for about 1/3 of the world's population. Among the other two thirds, where the increase is about one million per week, the problem of providing ample food supplies seems to be insolvable.

4. Organisms that cause diseases

5. When the pathogen enters the plant tissue

6. Transfer of some of the pathogen to the plant

7. At the time the plant reacts to the organism

8. During the inoculation and incubation stages

9. Obligate parasites that cause infection only in living cells

10. a. Yellows cause yellowing, curling, and dwarfing of the leaves. Also, internodes are shortened, excessive branching occurs, and galls are formed on plants.
    b. Mosaic viruses cause a breakdown of plant tissue. The destruction of plant tissue causes a mottling and spotting appearance on the infected areas.

11. Bacteria are one-celled "plants". They are the smallest of living organisms.

12. They cause most plant diseases.

13. Inconspicuous round worms (1/64 to 1/8 inch) that generally feed on plant tissue.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Cotton Pickers and Cotton Strippers

Picker:

1. a. By the method of mounting
   b. By the number of rows harvested
   c. By the height of the picking drums
   d. By the type of spindle used

2. a. Tractor attachment
   b. Self-propelled unit

3. One or two rows

4. a. 20 rows
   b. 14 rows

5. a. Tapered tooth
   b. Straight tooth

6. a. Gatherers or stalk lifters
   b. Picker unit
   c. Doffers
   d. Spindle moistener
   e. Conveyor unit
   f. Cleaning gates

Stripper:

1. Cotton strippers are tractor driven and are either mounted or trailing. Size range is 1 or 2-row machines.

2. Strippers are designed to harvest stormproof or semi-stormproof varieties. The plants are usually less than 30 inches tall. Because stripping is a once-over operation, harvesting is delayed until most bolls are open.

3. a. Roll strippers
   b. Finger strippers

UNIT: Harvesting Equipment
TOPIC: Cotton Pickers and Cotton Strippers
(Answer Sheet continued)

4. The roll stripper employs one or more revolving rollers to strip the cotton stalk. The material used in these rollers may be steel, fabric, rubber, or bristle brushes. Steel rollers are most common.

5. a. Gathering mechanism
   b. Cleaning and conveying mechanism

6. a. The gathering mechanism lifts and guides the cotton plants into the stripper. Either a finger, roll type, or brush stripping unit strips the bolls from the cotton plant.
   b. The cleaning and conveying mechanism cleans and conveys the cotton. The stripped material is cleaned while being conveyed from the stripping unit to the wagon or carrying basket. Cleaning is done either with open grills or grates or fans. Rubber flights attached to a heavy rubber belt carry the cotton to a trailer behind the tractor. Dirt, dust, and loose trash fall through the screened bottom of the side conveyors, as well as the center-delivery cross conveyor, and drop to the ground.

7. a. Gathering units
   b. Stripper rolls
   c. Operating speed
   d. Chain and belt tension
   e. Clean-outs, doors, and grills
   f. Safety clutch

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Corn Snappers, Corn Pickers, Corn Picker-Shellers, and Corn Combines

1. a. Corn Snapper
   b. Corn Picker
   c. Corn Picker-Sheller
   d. Corn Combine

2. a. Corn Snapper - Removes ears from standing stalk - does not husk.
   b. Corn Picker - Removes ear from stalk and husks the ear.
   c. Corn Picker-Sheller - Removes ear from stalk, husks ear, shells kernels from cob.
   d. Corn Combine - Snaps ear from stalk, shells kernels from cob, separates and cleans grain from plant stalks and husks

3. a. Gathering unit
   b. Snapping unit
   c. Husking unit
   d. Cleaning unit
   e. Shelled corn saver
   f. Shelling attachments
   g. Wagon elevator and hopper

4. a. Plant characteristics
   b. Mechanical factors
   c. Miscellaneous factors

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Forage Harvesting Equipment

Mowers:

1. a. Trail - behind mower
   b. Integral rear - mounted mower
   c. Side or center - mounted mower

2. a. Frame
   b. Cutter-bar assembly
   c. Mower drives

3. The frame supports the drive and cutting bar mechanism.

4. a. Knife
   b. Knife bar
   c. Sections
   d. Guards
   e. Knife clips
   f. Outer shoe
   g. Inner shoe
   h. Knife head
   i. Wear plates
   j. Ledger plate

5. a. Pitman
   b. Wrist pin or crank pin
   c. Pitman box
   d. Fly wheel
   e. Pulley

Rakes:

1. a. Side-delivery
   b. Dump
   c. Sweep

UNIT: Harvesting Equipment
TOPIC: Forage Harvesting Equipment--Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment
(Answer Sheet continued)

2. a. Cylindrical-reel
   b. Parallel-bar
   c. Side-stroke
   d. Finger-wheel

3. The function of the side-delivery rake is to lift the hay from the swath and place it in a loose, fluffy windrow with the green leaves inside, protected from the sun's rays.

4. a. Reel assembly
   b. Frame
   c. Drive mechanism

5. a. Shaft
   b. Bar
   c. Teeth
   d. Spiders
   e. Bearings
   f. Special bar-rotating devices

6. a. The rake ends are adjusted up or down.
   b. The basket can be changed in relation to the rake frame.
   c. Make vertical adjustment of the reel axles shaft at each end of the basket.
   d. The height of the reel and basket may be adjusted with bolts, or with the rear caster wheels.
   e. The basket and reel are both free to float up and down together.

7. a. Tractor PTO
   b. Traction driven

Hay Conditioners:
1. a. Crushing
   b. Crimping
   c. Flailing

2. a. Speeds field curing (Conditioning can reduce drying time by about 30%)
   b. Reduces weather damage
   c. Conserves color and feed value through shorter exposure and less shattering

UNIT: Harvesting Equipment
TOPIC: Forage Harvesting Equipment--Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment
(Answer Sheet continued)

3. a. Smooth roll
   b. Corrugated roll or crimper
   c. Flail-type forage harvester

4. a. The smooth-roll type may use 2 rubber rolls or a combination of a rubber roll and a steel roll. The smooth rolls give a continuous crushing action to the hay, leaving no part uncrushed. Most rubber rolls have special grooves to aid in picking up the hay and feeding it between the rolls.
   b. The corrugated-roll or crimper-type conditioner may be equipped with 2 malleable-iron rolls, with tapered flutes that mesh together similarly to gear teeth, or with slatted bar rolls. Some models use a fluted or bar roll that presses against a smooth rubber roll. As the hay presses between the rolls, it is bent, crimped, and cracked at intervals but not completely crushed.
   c. The flail-type conditioner is really a harvester; but when it is used as a hay conditioner, the shear bar is removed to reduce the cutting action. The hay is partially chopped by swinging hammers and knives.

Windrowers:
1. a. Trailing
   b. Self-propelled

2. a. Cuts
   b. Windrows
   c. Conditions

3. a. Mower
   b. Rake
   c. Conditioner

4. a. Cutter bar
   b. Reel

5. a. Auger
   b. Canvas

Balers:
1. a. Stationary
   b. Windrow pickup

UNIT: Harvesting Equipment
TOPIC: Forage Harvesting Equipment--Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment
(Answer Sheet continued)

2. a. Wire
   b. Twine

3. a. PTO of tractor
   b. Air-cooled engine

4. Most manufacturers rate their machines by bales per minute or tons per hour. The tons per hour may not be a satisfactory figure. If the hay is rather damp, the tons per hour will be greater because each bale weighs more. Bales per minute is a better measure.

5. a. Pickup automatic self-tying balers which make rectangular bales
   b. Pickup automatic baler making round bales

6. a. The area necessary to store it
   b. The width of the machine when on the highway

7. a. Pickup
   b. Feeding
   c. Compressing
   d. Tying

8. The usual type of pickup mechanism on the baler consists of a drum or cylinder with spring teeth. The cylinder rotates in the opposite direction of the motor of the baler, lifting the hay, and moving it into the machine.

9. a. Auger and packer fingers
   b. Spring teeth and feeder arms
   c. Auger and feeder head
   d. Carrier-roller feed

10. a. Plunger
    b. Bale chamber
    c. Tension bars or rails
    d. Retaining plates

11. a. Frame
    b. Wheels
    c. Tongue

UNIT: Harvesting Equipment
TOPIC: Forage Harvesting Equipment---Mowers, Rakes, Hay Conditioners, Windrowers, Balers, Silage Choppers, and Wafering Equipment
(Answer Sheet continued)

Silage Choppers:

1. The primary purpose of the forage harvester is to chop field crops and place the chopped crop in a wagon.

2. a. Field chopper
   b. Flail chopper

3. a. Tractor-drawn
   b. Tractor-mounted
   c. Self-propelled

4. a. Wheels
   b. Axle
   c. Frame
   d. Cutter-head
   e. Blower
   f. Feeding machine

5. a. Cutting and feeding
   b. Chopping
   c. Blowing

6. a. Windrow pickup attachment
   b. Cutter bar attachment
   c. Row-crop attachment

7. a. Flywheel
   b. Cylinder

Wafering Equipment:

1. Feedlot feeding of cattle (cubes cut down the storage space needed for hay)

2. Hay is windrowed as when prepared for baling. After proper drying, the hay is picked up with a pickup mechanism and delivered into a hopper. From the hopper the hay is fed into compressing dies. Hydraulic pressure (100-1000 lbs. per square inch) is applied and the hay is compressed into cubes (1 x 2, 2 x 2, or 3 x 3 inch cubes)

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Combines

1. a. Pull type
    (1) PTO
    (2) Auxiliary engine to supply cutting and threshing power
   b. Self-propelled

2. a. Cutting the standing grain
   b. Feeding the cut grain to the cylinder
   c. Threshing the grain from the stalk or stem
   d. Separating the grain from the straw
   e. Cleaning the grain by removing the chaff and other foreign matter
   f. Grain handling from combine to tank and from tank to truck

3. Two paths of progress lead to the modern combine:
   a. The development of implements for reaping
   b. The development of implements for threshing

4. Combine sizes are expressed by the width of the swath it can cut. Smaller sizes cut a 5-foot swath and larger sizes as much as a 20-foot swath.

5. a. Cutting unit, or header
   b. Feeding unit
   c. Threshing unit
   d. Cleaning unit
   e. Grain-handling unit

UNIT: Harvesting Equipment
TOPIC: Combines
(Answer Sheet continued)

COMBINE CROSS SECTION

A - Cutting and Feeding Mechanisms
  1 - Reel
  2 - Cutter Bar
  3 - Feeding Auger
  4 - Feeding Conveyor

B - Threshing Mechanism
  5 - Cylinder
  6 - Concave
  8 - Cylinder Beater

C - Separating Mechanism
  7 - Concave Gate
  10 - Straw Rack
  11 - Check Flap
  12 - Grain Conveyor

D - Cleaning Mechanism
  9 - Grain Pan
  13 - Adjustable Chaffer
  14 - Adjustable Chaffer Extension
  15 - Sieve
  16 - Fan
  17 - Windboard
  18 - Clean Grain Auger
  19 - Tailings Auger
  20 - Tailboard

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Harvesting Equipment

TOPIC: Small Grain Drills and Spin Broadcast Seeders

1. Many things must be considered in determining the method of harvesting small grains but the two most important ones are the types of equipment available for harvesting and what use will be made of the crop. These two points must receive consideration before any harvesting operation is begun and most of the other factors such as storage, weather, market, amount of grain, etc. will depend on them to a great extent.

2. The main thing to consider before combining or threshing small grain is whether or not it will be profitable to thresh this year. This question is not easily answered and it will require considerable thought and judgment on the part of the farmer. The farmer may ask if there is enough grain to pay for the combining. This would depend on: weather conditions, price of the grain at that time and later in the year; whether the farmer has his own combine, plans to sell the grains or use them himself, or has adequate storage facilities. Perhaps even more important than these questions would be how much the farmer will need his grain in winter feeding his livestock.

3. The same question that is mentioned about threshing small grains could be applied here, the main difference being the availability of equipment to harvest, and the primary use of the small grains on the farm.

4. The question of grazing rather than threshing or baling small grain always comes up. This question is not easily answered but a good rule to follow would be: if the conventional harvesting methods cost more than buying grains later (depending on amount and quality of grains in the field) then it is wiser to graze. This would usually apply to poor stands or to fallen stands of oats, wheat, and barley. Rice is not ordinarily grown for livestock feed, and the moisture stress is not as great in rice growing areas as it is in the areas where the other grains are grown.

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Cotton

1. Various species of cotton are native to the tropical and subtropical areas of both the Old World and the New World. India was the first country noted for the use of cotton; however, areas of Africa, Peru, and Mexico have been using cotton for thousands of years. Leading cotton-producing countries are United States, Russia, India, Mexico, United Arab Republic, Brazil, and Pakistan. Leading cotton-producing states in the United States are Texas, Arkansas, Mississippi, and Tennessee. Cotton played an important part in bringing about the "Industrial Revolution" in England.

2. Uses of Cotton are:
   a. Fiber
      (1) Apparel
      (2) Household
      (3) Industrial
   b. Cottonseed
      (1) Oil
      (2) Meal
      (3) Hulls
      (4) Linters

3. Natural hazards to cotton production are:
   a. Plant pests
      (1) Pathogen - diseases
      (2) Predators - insects
      (3) Weeds - competitors for nutrients and moisture
   b. Hail
   c. Moisture
      (1) Lack of
      (2) Excess of
      (3) Received at wrong time

4. Plant characteristics to consider when selecting a variety of cotton are:
   a. Yield ability
   b. Percentage of lint
   c. Earliness
   d. Size and kind of boll

UNIT: Major Crops
TOPIC: Cotton
(Answer Sheet continued)

   e. Plant type
   f. Kind and size of leaf
   g. Storm resistance
   h. Seed size
   i. Disease resistance
   j. Insect resistance

5. Fiber properties to consider when selecting a variety of cotton are:
   a. Staple
   b. Strength
   c. Fineness
   d. Maturity
   e. Uniformity

6. Cotton is most responsive to phosphorus and nitrogen.

7. Dates for planting cotton are varied from February in the lower Rio Grande Valley to the middle of June in the High Plains area. Generally, the soil temperature should be 60° F. for several days before planting.

8. Planting rates for cotton are:
   a. Fuzzy seed - 33 lbs./acre
   b. Mechanically delinted seed - 12-15 lbs./acre
   c. Acid delinted seed - 8-10 lbs./acre

9. Reasons for cultivating cotton are:
   a. Destroy weeds
   b. Loosen the soil
   c. Permit better aeration of the soil
   d. Permit better penetration of water into the soil
   e. Promote decomposition of organic matter in the soil
   f. Increase crop yields

10. Equipment used to cultivate cotton includes:
   a. Ordinary cultivator equipped with suitable sweeps
   b. Harrows
   c. Rotary hoes
   d. Sled cultivators

11. For normal cotton production from 24-36 inches of water are required per year.

UNIT: Major Crops
TOPIC: Cotton
(Answer Sheet continued)

12. Most cotton today is harvested by either a cotton stripper or a cotton picker. Very little cotton is harvested by hand.

13. a. True defoliants cause leaf fall with minimal drying.
    b. Defoliant-desiccants dry the leaves, stalks, and bolls rapidly with little leaf fall.
    c. True desiccants induce rapid killing and drying with very little leaf fall.

14. Defoliants may be applied by:
    a. Airplanes
    b. Ground sprayers

15. Major insects attacking cotton are:
    a. Thrips
    b. Cotton aphid
    c. Cotton fleahopper
    d. Boll weevil
    e. Bollworm
    f. Tobacco budworm
    g. Pink bollworm
    h. Cotton leafworm
    i. Brown cotton leafworm
    j. Cabbage looper
    k. Lygus bugs
    l. Stink bugs
    m. Spider mites

16. Minor cotton insects are:
    a. Cotton square borer
    b. Salt-march caterpillar
    c. Garden webworm
    d. Yellow-striped armyworm
    e. Fall armyworm
    f. Grasshoppers

UNIT: Major Crops
TOPIC: Cotton
(Answer Sheet continued)

17. Beneficial cotton insects include:
    a. Flower bug
    b. Lady beetles
    c. Lace-winged fly or aphid lion
    d. Big-eyed bugs
    e. Hooded beetle
    f. Soft-winged flower beetle
    g. Ground beetles
    h. Assassin bugs
    i. Nabid or damsel bug
    j. Spiders

18. There are two methods used to check a field for bollworms.
    a. Examine the terminal buds of 100 cotton plants and 100 consecutive squares and bolls at each of several points in the field. Begin treatment when bollworm eggs and four to five young worms are found per 100 terminals or 5 % of the squares and small bolls have been injured by small bollworms.
    b. Make a whole plant examination (terminals, squares, flowers, or bolls) of all plants on 10 feet of row in at least five locations in the field. When larval counts average more than 1.5 larvae per 10 feet of row or exceed 7 larvae in 50 feet of row, begin treatment.

19. The major diseases attacking cotton in Texas are:
    a. Fusarium wilt
    b. Verticillium wilt
    c. Root rot
    d. Seedling diseases
    e. Nematodes
    f. Bacterial blight
    g. Boll rots
    h. Fungus leaf spots

20. Cotton classification includes the determination of grade, staple length, and micronaire reading of the cotton in a sample.

UNIT: Major Crops
TOPIC: Cotton
(Answer Sheet continued)

21. Grade represents a combination of the following factors:
    a. The color of most American Upland cotton is white, but cotton may also be classified as light spotted, spotted, tinged, yellow stained, light gray, or gray.
    b. The leaf includes dried and broken plant foliage and other trash or foreign matter remaining in the lint after ginning. The more leaf in a sample, the lower the grade.
    c. Preparation denotes the degree of smoothness with which the cotton is ginned and the relative nappiness or neppiness of the ginned cotton. Rough preparation reduces the grade of cotton.

22. The grade names and their symbols for white cotton are:
    a. Strict good middling - SGM
    b. Good middling - GM
    c. Strict middling - SM
    d. Middling - M
    e. Strict low middling - SLM
    f. Low middling - LM
    g. Strict good ordinary - SGO
    h. Good ordinary - GO
    i. Below grade - BG

23. Codes for staple length and the equivalent length for each code are:
    a. 24 - below 13/16 inch
    b. 26 - 13/16 inch
    c. 28 - 7/8 inch
    d. 29 - 29/32 inch
    e. 30 - 15/16 inch
    f. 31 - 31/32 inch
    g. 32 - 1 inch
    h. 33 - 1 1/32 inches
    i. 34 - 1 1/16 inches
    j. 35 - 1 3/32 inches
    k. 36 - 1 1/8 inches
    l. 37 - 1 5/32 inches
    m. 38 - 1 3/16 inches
    n. 39 - 1 7/32 inches
    o. 40 - 1 1/4 inches

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Corn

1. Corn was the most valuable crop found in the New World. A crop believed native to southern Mexico, it had spread throughout the Americas by the time the first European explorers came to America. It is now grown throughout the world. The United States is by far the leading producer of corn, producing over 50% of the total world production. Other leading countries are Russia, Brazil, Yugoslavia, Mexico, Argentina, Rumania, and South Africa. Leading corn producing states in the United States are Iowa, Illinois, Indiana, Minnesota, Nebraska, Ohio, Missouri, Wisconsin, and South Dakota. Through plant breeding (development of hybrids) yields have been greatly improved. New developments in plant breeding are increasing the protein content of corn and will increase the importance of corn as a source of food for both man and livestock.

2. Uses of corn include:
   a. Feed for livestock
      (1) Grain
      (2) Silage
      (3) Fodder
      (4) Pasture
   b. Food for Man
      (1) Corn (grain)
      (2) Corn meal
      (3) Hominy
      (4) Corn flakes
   c. Industrial uses
      (1) Alcohol
      (2) Corn starch
      (3) Corn oil
      (4) Corn syrup
      (5) Corn sugar
      (6) Corn gluten feed
      (7) Corn oil meal
      (8) Paper manufacturing
      (9) Insulation manufacturing
      (10) Cardboard manufacturing

UNIT: Major Crops
TOPIC: Corn
(Answer Sheet continued)

(11) Pipes
(12) Chemicals
(13) Plastics
(14) Methanol
(15) Tar
(16) Furfural

3. Natural hazards for corn production include:
   a. Plant pests
      (1) Pathogens - diseases
      (2) Predators - insects, rodents, birds
      (3) Weeds - competitors for nutrients and moisture
   b. Fire
   c. Hail
   d. Frost
   e. Moisture
      (1) Lack of
      (2) Excess of
      (3) Received at wrong time

4. The six groups of corn varieties are:
   a. Dent corn (95% total U.S. corn is dent)
   b. Flint corn
   c. Sweet corn (for human consumption)
   d. Popcorn
   e. Soft corn
   f. Popcorn

5. Factors to consider in selecting hybrid strains are:
   a. Adaptation to climate of area
   b. Adaptation to soil of area
   c. Disease resistance
   d. Insect resistance
   e. Germination of seed
   f. Plant growth
   g. Development of root system
   h. Yield
   i. Maturity time

UNIT: Major Crops
TOPIC: Corn
(Answer Sheet continued)

6. The amount and type of food nutrients (fertilizer) required by corn plants is determined through soil tests.

7. Lack of plant nutrients is more readily seen in corn than any other crop. Soils low in nitrogen, phosphorus, or potassium produced corn plants showing symptoms of the lack of these nutrients. Other minor nutrients may also develop characteristic symptoms if deficient. Thus, corn readily responds to the application of fertilizers. In most cases when fertilizers are applied, we can see the following results:
   (1) higher yields
   (2) improved grain quality
   (3) earlier maturity

8. As a general rule, corn will be planted in early spring, as soon as the danger from frost is over and ground temperature reaches 70 degrees.

9. Corn planting rate is determined by:
   a. Fertility of soil
   b. Amount of available moisture in the soil
   c. Purpose for which the crop is to be used
   d. Variety grown
   e. Percent germination

10. Equipment used for planting corn includes:
   a. Corn planters
   b. Lister planters
   c. Drills

11. Corn is cultivated to:
   a. Control weeds
   b. Conserve moisture
   c. Aerate soil

12. Equipment used to control corn includes:
   a. Corn cultivators
   b. Spike-tooth harrows
   c. Rotary hoes
   d. Spraying equipment if chemical weed control is practiced

UNIT: Major Crops
TOPIC: Corn
(Answer Sheet continued)

13. For each pound of dry matter produced by the corn plant, 368 pounds of water are required.

14. The use the corn is grown for determines the method of harvesting.
    a. Grain - pickers, picker-shellers, combines
    b. Silage - forage harvesters
    c. Pasture - livestock

15. a. When the corn ears are gathered, moisture content of ears should be 15-30% (15-22% is preferred).
    b. When the corn is threshed (grain then stored), the moisture content of the grain should be below 13%.
    c. When harvested as high-moisture corn for livestock feeding (Stored in silo), the moisture content of the grain should be 25-30%.
    d. When harvested as silage, the grain should be in the early dent stage.

16. Major diseases attacking corn are:
    a. Corn smut
    b. Gibberella (Seedling blight, stalk rot, ear rot, and kernel rot)
    c. Diplodia (Seedling blight, stalk rot, ear rot)
    d. Nigrospora cob rot
    e. Leaf blights
    f. Bacteria wilt

17. Major insects attacking corn include:
    a. European corn borer
    b. Chinch bug
    c. Corn ear worm
    d. Corn rootworms
        (1) Northern rootworm
        (2) Southern rootworm
        (3) Western rootworm
    e. Corn root aphid
    f. Southern cornstalk borer

UNIT: Major Crops
TOPIC: Corn
(Answer Sheet continued)

18. USDA grades for corn grain are:
    a. No. 1
    b. No. 2
    c. No. 3
    d. No. 4
    e. No. 5
    f. Sample grade

19. Factors which determine grade for grain corn are:
    a. Weight
    b. Moisture content
    c. Amount of cracked grain and foreign material
    d. Amount of damaged grain
    e. Amount of heat damaged kernels

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Forage and Hay Crops

1. The major forage and hay crops include:
   a. Forage sorghums
      (1) Sorgo and dual-purpose varieties
      (2) Forage sorghum hybrids
      (3) Dual-purpose grain and forage hybrids
   b. Grass sorghums
      (1) Sudangrass varieties and hybrids
      (2) Sorghum-Sudangrass hybrids
      (3) Johnson grass, sorghum almum, and perennial sorgrass
   c. Bermuda grass

   (Some small grains, grain sorghums, alfalfa and sweet clovers are also used as forage and hay crops, but are discussed as individual crops with this unit.)

2. Sorghums are native to Africa and have been cultivated by man since prehistoric times. While most sorghums (world-wide) are used for human food, in the United States sorghums are raised primarily for livestock and poultry feeds. The sorgo varieties are used mainly for silage and were introduced to Texas about 1850. Milo and kafir varieties were introduced about 1880 in South Carolina. In the early 1900's feterita, hegari, and Sudangrass varieties were introduced to the United States from the Sudan region of Africa. Our sorgo varieties range from 5-14 feet in height, giving good yields for silage production.

3. Bermuda grass grows throughout the tropical and subtropical regions of the world. It is thought to be native to India or Africa. This grass was brought to the United States about 1750. It is thought to be the most important grass in the South.

4. Uses of forage and hay crops are:
   a. Forage sorghums
      (1) Hay
      (2) Silage
      (3) Syrup
   b. Grass sorghums
      (1) Pasture
      (2) Hay
      (3) Silage

UNIT: Major Crops
TOPIC: Forage and Hay Crops
(Answer Sheet continued)

  c. Bermuda grass
    (1) Pasture
    (2) Hay

5. Major natural hazards to forage and hay crop production are:
  a. Plant pests
    (1) Pathogen - diseases
    (2) Predators - insects, birds
    (3) Weeds - competitors for nutrients and moisture
  b. Fire
  c. Hail
  d. Moisture
    (1) Lack of
    (2) Excess of
    (3) Received at wrong time
  e. Wind

6. Factors to consider in selecting forage sorghum and grass sorghum varieties are:
  a. Adaptability to area
  b. Time required to mature
  c. Drought resistance
  d. Disease resistance
  e. Resistance to lodging
  f. Height
  g. Yield
  h. Use

7. Factors to consider in selecting a Bermuda grass variety are:
  a. Adaptability
  b. Frost tolerance
  c. Drought resistance
  d. Yield
  e. Leaf, stem, etc.

8. Varieties for forage and hay crops include:
  a. Forage sorghums
    (1) Sorgo
      (a) Atlas

UNIT: Major Crops
TOPIC: Forage and Hay Crops
(Answer Sheet continued)

            (b) Sumac
            (c) African Millet
            (d) Kansas Orange
            (e) Axtell
            (f) Early Sumac
            (g) Rox
            (h) Rancher
            (i) Fremont
        (2) Dual purpose grain and forages
        (3) Hybrid forages
    b. Grass sorghums
        (1) Sudangrass
            (a) Common
            (b) Sweet
            (c) Wheeler
            (d) Piper
            (e) Stoneville
            (f) Tift
            (g) California 23
            (h) Greenleaf
            (i) Georgia 337
            (j) Lahoma
        (2) Johnson grass
        (3) Sudangrass hybrids
        (4) Sorghum-Sudangrass hybrids
    c. Bermuda grass
        (1) Common
        (2) Coastal
        (3) Swanee
        (4) Midland

9. Since moisture is generally the limiting factor for sorghum production, it often is wasteful to fertilize sorghums. However, under irrigated or more humid regions, sorghums respond quite favorably to the application of fertilizers, especially nitrogen fertilizers. Soils should be tested to determine the nutrients needed in areas where moisture makes fertilizing sorghums economical.

10. For best yields, Bermuda grass will need from 30-400 pounds of nitrogen fertilizer per acre per year. It is also necessary to add phosphorus and

UNIT: Major Crops
TOPIC: Forage and Hay Crops
(Answer Sheet continued)

potash fertilizers, especially after the Bermuda grass has been established for several seasons. Lime may also need to be added to prevent the soil from becoming too acid.

11. Equipment used to plant forage and grass sorghums include?
    a. Lister planter
    b. Grain drill

12. Generally sorghums should not be planted until soil temperature reaches 70° F. Planting dates for Texas range from March to July as a general rule.

13. Rates used for planting sorghums will vary greatly depending upon the intended use of the crop. When planted in rows for silage production, rates will range from 3-5 pounds per acre. When sowed for hay production, rates may range from 30-100 pounds per acre.

14. Bermuda grass may be propagated either by seed or by vegetative sprigs. Methods used for all small-seeded grasses or legumes should be used when planting seeds. Normal rates are 5-10 pounds per acre. Propagation by vegetative sprigs is more popular and used more often than seed. Special planting equipment is needed to collect and plant the sprigs.

15. Requirements for successful planting of Bermuda grass sprigs include:
    a. Plant sprigs as soon after they are dug as possible
    b. Do not allow sprigs to wilt badly or dry out between digging and planting operations
    c. Plant sprigs only in moist soil
    d. Plant just deep enough that part of the sprig is in moist soil and the tip of the sprig is above the ground
    e. Firmly pack soil around sprigs to help keep them moist until they are established

16. Cultivating Bermuda grass is done mainly to control weeds and may be done by:
    a. Mowers
    b. Turning sod with a bottom plow (This also stimulates Bermuda grass growth.)
    c. Chemicals

17. Standard row-crop methods of cultivation are used on forage and grass sorghums planted in rows for silage. Standard cultivators, rotary hoes,

UNIT: Major Crops
TOPIC: Forage and Hay Crops
(Answer Sheet continued)

knives, etc. are used. When these crops are drilled in for hay production weed control is done by chemicals or is carried out before the crop is planted.

18. The forage and grass sorghums will produce well in areas of limited rainfall (17-25 inches per year). For higher yields, these crops need additional moisture and respond most favorably under irrigated conditions. Sudangrass requires 359 pounds of water for each pound of dry matter produced.

19. Methods of harvesting forage and hay crops depend upon use of the crop:
    a. Silage - harvested with forage harvesters.
    b. Hay - harvested with mowers, rakes, hay conditioners, windrowers, and balers.
    c. Pasture - harvested by livestock.

(Use of hay conditioners play an important role in harvesting forage and grass sorghums for hay. The thick, juicy stalks of these plants are hard to cure to the proper moisture content without the use of conditioners. When conditioners are not used, the crop must field cure for a longer period of time; and thus, it is subject to more unfavorable weather conditions.)

20. Major insects attacking forage and hay crops in Texas include:
    a. Chewing insects which eat foliage and fruit of the plant
        (1) Grasshoppers
        (2) Armyworm
        (3) Fall armyworm
        (4) Beet armyworm
        (5) Yellow-striped armyworm
        (6) Corn earworm
        (7) Cabbage loopers
        (8) Green cloverworm
        (9) Variegated cutworm
        (10) Alfalfa caterpillar
        (11) Garden webworm
        (12) Salt-marsh caterpillar
        (13) Sorghum webworm
        (14) Flea beetle
        (15) Cowpea weevil
        (16) Vetch bruchid
        (17) Blister beetle
        (18) Spotted cucumber beetle

UNIT: Major Crops
TOPIC: Forage and Hay Crops
(Answer Sheet continued)

- (19) Ants
- (20) Sorghum midge
- (21) Clover seed chalcid
- (22) Clover seed midge

b. Chewing insects which feed upon or within stems or roots of the plant:
- (1) Southwestern corn borer
- (2) Sugar cane borer
- (3) Lesser cornstalk borer
- (4) Sugar cane rootstock weevil
- (5) Clover stem borer
- (6) Cutworm
- (7) Seed-corn maggot
- (8) Sweet clover root borer
- (9) Southern corn rootworm
- (10) Wireworm
- (11) False wireworm
- (12) White grub (May beetle)
- (13) Sod webworm

c. Sucking insects
- (1) Corn leaf aphid
- (2) Spotted alfalfa aphid
- (3) Greenbug
- (4) Pea aphid
- (5) Three cornered alfalfa hopper
- (6) Lygus bug
- (7) Leaf-footed bug
- (8) Thrips
- (9) Stink bug
- (10) Chinch bug
- (11) False chinch bug
- (12) Leafhopper
- (13) Mites

21. Groups of insects beneficial for forage and hay crops are:

a. Predaceous insects
- (1) Lady beetles
- (2) Ground beetles
- (3) Lacewings
- (4) Syrphid flies
- (5) Spiders

UNIT: Major Crops
TOPIC: Forage and Hay Crops
(Answer Sheet continued)

- b. Parasites
    - (1) Wasps
    - (2) Chalcid flies
- c. Bees

22. Major sorghum diseases are:
    - a. Covered kernel smut
    - b. Loose kernel smut
    - c. Head smut
    - d. Leaf blight

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Grain Sorghum

1. Grain sorghums are very versatile as they are used for livestock feed, human food, and industrial uses. They are also a very old crop, having been cultivated at least 2,000 years B.C. in Egypt. Sorghums are raised throughout the tropical and temperate areas of the world. Leaders in grain sorghum production are the United States, India, Argentina, Ethiopia, Sudan. The sorghums were first introduced to the United States in about 1700. Their use became more important in the late 1800's when the more arid western land was settled. Grain sorghums are planted on more acres in Texas than any other crop and their value now exceeds the value of lint from cotton in Texas.

2. Uses of grain sorghums include:

   a. Feed for livestock
      (1) Grain
      (2) Silage
      (3) Pasture
   b. Human food
   c. Industrial uses
      (1) Starch
      (2) Waxes
      (3) Alcohol
      (4) Brewing industry

3. Natural hazards to grain sorghum production are:

   a. Plant pests
      (1) Pathogen - diseases
      (2) Predators - insects
      (3) Weeds - competitors for nutrients and moisture
   b. Fire
   c. Hail
   d. Moisture
      (1) Lack of
      (2) Excess of
      (3) Received at wrong time
   e. Wind

UNIT: Major Crops
TOPIC: Grain Sorghum
(Answer Sheet continued)

4. Over 500 varieties of grain sorghums are grown in the United States.

5. Grain sorghum varieties are grouped into:

   a. Milo
   b. Kafir
   c. Feterita
   d. Hegari
   e. Sorgo

6. Early grain sorghum varieties used to develop many of our hybrid varieties include:

   a. Martin
   b. Redbine 60
   c. Redbine 66
   d. Combine Kafir 60
   e. Plainsman
   f. Caprock
   g. Double Dwarf Yellow Sooner
   h. Double Dwarf White Sooner
   i. Early Hegari
   j. Bonita
   k. Westland
   l. Combine 7078

7. Thirteen factors that should be considered in selecting a variety of grain sorghum are:

   a. Compact or loose head
   b. Exsertion
   c. Lodge resistance
   d. Uniform height
   e. Head drying
   f. Tillering
   g. Size of seed
   h. Hardness of seed
   i. Drought resistance
   j. Insect and disease resistance

UNIT: Major Crops
TOPIC: Grain Sorghum
(Answer Sheet continued)

 k. Even-maturing
 l. Threshing quality
 m. Grazing quality

8. Grain sorghums respond very favorably to the application of nitrogen fertilizers. Normally, little response is shown to phosphorus and potassium fertilizers; however, soils should be tested to determine what nutrients are needed.

9. Grain sorghums are small season plants and will do better if planted after soil temperature reaches 70°F.

10. Recommended rates for planting grain sorghums are:

 a. 4-6 lbs. per acre for dry land
 b. 6-12 lbs. per acre for irrigated land or for humid areas
 c. 12-15 lbs. per acre if drilled for dry land conditions

11. Grain sorghums may be planted with:

 a. Regular planters with grain sorghum plates
 b. Grain drills

12. Equipment needed for cultivating grain sorghums include:

 a. "Go devils"
 b. Knives
 c. Rotary hoes
 d. Regular row crop cultivators
 e. Spraying equipment if herbicides are used

13. The main reason for cultivating grain sorghums is to control weeds.

14. In favorable years, 16-18 inches of moisture are required. If the weather is extremely hot and dry, 24 inches of water may be required for good yields.

15. Grain sorghums are harvested by:

 a. Combines - for grain
 b. Forage harvesters - for silage
 c. Livestock - for pasture

UNIT: Major Crops
TOPIC: Grain Sorghum
(Answer Sheet continued)

16. The moisture content of the grain should be near 12% before grain sorghums are harvested.

17. Major insects attacking grain sorghums include:

    a. Insects eating foliage and fruit:
        (1) Grasshoppers
        (2) Armyworm
        (3) Fall armyworm
        (4) Beet armyworm
        (5) Corn earworm
        (6) Variegated cutworm
        (7) Sorghum webworm
        (8) Flea beetles
        (9) Texas leaf-cutting ant
        (10) Sorghum midge
    b. Insects feeding upon or within stems and roots:
        (1) Southwestern corn borer
        (2) Sugar cane borer
        (3) Cutworms
        (4) Southern corn rootworm
        (5) May beetles
        (6) Wireworms
    c. Sucking insects
        (1) Corn leaf aphid
        (2) Greenbug
        (3) Lygus bugs
        (4) Thrips
        (5) Stinkbugs
        (6) Chinch bug
        (7) False chinch bug

18. Insects beneficial to grain sorghums include:

    a. Predaceous insects
        (1) Lady beetles
        (2) Ground beetles
        (3) Lacewings
        (4) Syrphid flies
        (5) Spiders

UNIT: Major Crops
TOPIC: Grain Sorghum
(Answer Sheet continued)

b. Parasites
   (1) Wasps
   (2) Chalcid flies

19. The four groups of diseases attacking grain sorghums are:

   a. Those that rot the seed and kill young seedlings
   b. Those that attack the leaves
   c. Those that attack the head (grain)
   d. Those that rot the roots and stalk

20. Five pathogen groups are:

   a. Fungi
   b. Bacteria
   c. Viruses
   d. Nematodes
   e. Mycoplasma

21. The first step in a program to control sorghum diseases should be to recognize the problem.

22. Four classes of grain sorghums are:

   a. Yellow grain sorghum
   b. White grain sorghum
   c. Brown grain sorghum
   d. Mixed grain sorghum

23. The seven grain sorghum grades are:

   a. No. 1
   b. No. 2
   c. No. 3
   d. No. 4
   e. Sample
   f. Smutty (Special grade)
   g. Weevily (Special grade)

UNIT: Major Crops
TOPIC: Grain Sorghum
(Answer Sheet continued)

24. Dockage is the following:

    a. Sand
    b. Dirt
    c. Finely broken kernels of grain sorghum
    d. Weed seeds
    e. Other material that will readily pass through a 2 1/2/64 inch sieve

25. Grain sorghum cannot contain more than 13% moisture and be graded No. 1.

26. Damaged-kernels (total) includes kernels or pieces of kernels that have the following damage:

    a. Heat-damaged
    b. Sprouted
    c. Frosted
    d. Badly ground-damaged
    e. Badly weather-damaged
    f. Moldy
    g. Diseases
    h. Otherwise materially damaged

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Peanuts

1. The peanut is native to Brazil, but it is more widely used in other areas of the world. Leading peanut producing countries are India, China, Nigeria, Senegal, United States, Indonesia, and Brazil. States in the United States which lead in peanut production are Georgia, Texas, North Carolina, Alabama, and Oklahoma.

2. Uses of the peanut include:
   a. Oil
   b. Livestock feed
      (1) Protein supplement
      (2) Hay
   c. Human food

3. Natural hazards to peanut production are:
   a. Plant pests
      (1) Pathogen - diseases
      (2) Predators - insects
      (3) Weeds - competitors for nutrients and moisture
   b. Fire
   c. Hail
   d. Moisture
      (1) Lack of
      (2) Excess of
      (3) Received at wrong time

4. The four groups of peanuts are:
   a. Virginia
   b. Runner
   c. Spanish
   d. Valencia

UNIT: Major Crops
TOPIC: Peanuts
(Answer Sheet continued)

5. Leading varieties of Spanish peanuts are:
   a. Dixie Spanish
   b. Argentine
   c. Starr
   d. Spantex
   e. Spanette
   f. Comet
   g. Spanhoma

6. Three main factors to consider when selecting a variety of peanuts are:
   a. Adaptability
   b. High vigor
   c. High germination

7. To produce 1 1/2 tons of nuts and 2 1/2 tons of hay from an acre of land would remove 215 pounds of nitrogen, 40 pounds of phosphorus, 116 pounds of potassium, and 70 pounds of calcium.

8. Peanuts should be planted after soil temperature reaches 75° F.

9. Depending upon moisture conditions from 35-130 pounds of peanuts are planted per acre.

10. Special peanut planters or corn or cotton planters equipped with peanut plates may be used for planting peanuts.

11. The main reason for cultivating peanuts is to control weeds. It has not been proven that cultivation, which loosens the soil so that the pedicels can penetrate the soil more readily, will increase yields.

12. a. Cutting the tap root and loosening the soil around the peanut.
    b. Lifting the vine and nut from the soil, shaking the loose dirt from the vine and nuts by passing them over a shaker, and collecting the vine and nuts in windrows.
    c. Picking up the vines and nuts, passing them through a picker (thresher), and separating the nuts from the vine.

UNIT: Major Crops
TOPIC: Peanuts
(Answer Sheet continued)

13. Generally speaking, the plant of the peanut has a tap root; however, the plant may have lateral roots which also produce nuts. For digging, a long flat knife should be used. This knife's cutting edge should extend backwards at a 30° angle. Sweeps may be used for this operation. Knives or sweeps may have rods for aiding in lifting the nuts from the soil. These knives and sweeps should be adjusted to windrow the vines and nuts.

14. To free the peanut of most of the dirt before the threshing operation, some form of shaking should take place. Side-delivery hay rakes may be used to gather several rows into one windrow. This process requires a longer drying period. Special machinery is available which will lift, shake, and place the vines and nuts in a loose windrow (for quicker drying). This special equipment if often attached to the digger.

15. a. Combine
    b. Thresher
    c. Picker-Thresher combination

16. a. Threshers have straight teeth as a grain thresher has--but they are spaced farther apart on the cylinder and concave bars.
    b. Pickers have spring teeth on both the cylinder and concave bars.

17. A pickup-feeder chute is added to the thresher to make a combine. (A combine may be a special peanut combine or it may be a converted grain combine.)

18. They must be dried.

19. Major peanut insects include:
    a. Corn earworm
    b. Thrips
    c. Leafhoppers
    d. White grubs (wireworms)
    e. Lesser cornstalk borer
    f. Cut worm
    g. Red-necked peanut worm
    h. Grasshoppers
    i. Velvet bean caterpillar
    j. Fall armyworm
    k. Spidermites
    l. Southern corn rootworm

UNIT: Major Crops
TOPIC: Peanuts
(Answer Sheet continued)

20. Major peanut diseases include:
    a. Leaf spot
    b. Southern blight
    c. Stem rot (white mold)
    d. Pod breakdown
    e. Collar rot
    f. Peanut rootrot
    g. Sting nematode
    h. Root knot nematode
    i. Meadow nematode

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Rice

1. Rice has been cultivated for over 5,000 years in China. It is the principal food for 60 percent of the world's population. More acreage is devoted to rice production than any other crop. Leading rice producing countries are China, India, Japan, Pakistan, and Indonesia. Rice became a commercial crop in Texas in 1905 and now ranks 5th in acreage for field crops in the state. Leading rice producing states are Texas, Louisiana, Arkansas, and California.

2. The main use of rice is for human food.

3. Natural hazards for rice production are:
    a. Plant pests
        (1) Pathogen - diseases
        (2) Predators - insects
        (3) Weeds - competitors for nutrients and moisture
    b. Hail
    c. Wind

4. Major rice varieties are:
    a. Long-grain varieties
        (1) Century Patna 231
        (2) Bluebonnet 50
        (3) Rexoro
        (4) TP-49
        (5) Texas Patna
        (6) Improved Bluebonnet
        (7) Sunbonnet
        (8) Toro
    b. Medium-grain varieties
        (1) Zenith
        (2) Nato
        (3) Magnolia
    c. Short-grain varieties
        (1) Asahi
        (2) Caloro

UNIT: Major Crops
TOPIC: Rice
(Answer Sheet continued)

5. Factors to consider when selecting a variety of rice are:
   a. Yield
   b. Date of maturity
   c. Disease resistance
   d. Stiffness of straw
   e. Type of grain
   f. Milling qualities of grain
   g. Table qualities of grain

6. a. Seeding of rice is done from March 1 to late June in Texas. Most is done in April and May.
   b. Seeding rates vary from 60 to 125 pounds per acre. The recommended rate is 90 pounds per acre.
   c. Airplanes are used for most seeding in Texas (both for dry and flooded fields). Grain drills may also be used.

7. 35-45 inches

8. Once rice is seeded, no mechanical cultivation takes place until the crop is harvested. Selected chemicals may be used to control weeds.

9. By rice combines

10. a. Size and arrangement of wheels (The rice combine is equipped with larger, deep mud lugs, which enable the machine to travel through the fields and over levees. Some are equipped with tracks.)
    b. Engines with greater horsepower are needed on rice combines in order for them to move through the muddy soil.

11. Major rice insects are:
    a. Rice stink bug
    b. Grasshopper
    c. Rice stalk borer
    d. Rice water weevils
    e. Army worm
    f. Sugar cane borer

UNIT: Major Crops
TOPIC: Rice
(Answer Sheet continued)

12. Major rice diseases are:
    a. Seedling diseases - Caused by soil-borne organisms such as Helminthosporium oryzae, Schlerotium rolfsii, and Rhizoctonia solani
    b. Stem rot
    c. Brown leaf spot
    d. Narrow brown leaf spot
    e. Blast
    f. Rotten neck
    g. Kernel smut
    h. Straight head

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Small Grains

1. Small grains are:
   a. Wheat
   b. Oats
   c. Barley
   d. Rye

2. a. Wheat:
   Wheat is an old crop having been raised for at least 9,000 years. It ranks second only to rice in world production. Generally, it is grown in areas too dry or cold for corn or rice. Leading wheat-producing countries are Russia, the United States, Canada, China, India, France, Turkey, Argentina, Australia, and Italy. It was first grown in America in 1602 on an island off the Massachusetts coast. Leading wheat-producing states in the United States are Kansas, North Dakota, Oklahoma, Nebraska, Montana, Illinois, Washington, Texas, and Colorado. Wheat is classed as either hard wheat or soft wheat.

   b. Oats:
   It is thought that oats were domesticated as a crop in Asia Minor about the time the Christian era began. Leading oat-producing countries are the United States, Canada, Russia, Poland, France, and Germany. They were first introduced to the United States in 1602 on the Elizabeth Islands off the coast of Massachusetts.

   c. Barley:
   Barley is another old crop, having been cultivated for over 5,000 years. It is thought to be native to either Abyssinia or Southern Tibet. Leading barley-producing countries are Russia, France, England, United States, Turkey, India, Morocco, and Argentina.

   d. Rye:
   Man began cultivating rye about the same time he did oats. Although rye is chiefly a European crop (leading countries are Russia, Poland, and Germany) it is believed to be native of Asia Minor. It is important as a crop in the United States because it will grow where other small grains will not. Leading states in the United States are North Dakota, South Dakota, Nebraska, Minnesota, and Kansas.

UNIT: Major Crops
TOPIC: Small Grains
(Answer Sheet continued)

3. Uses of the small grains are:
   a. Wheat
      (1) Making flour
         (a) Bread
         (b) Pastries
         (c) Cakes
         (d) Crackers
         (e) Macaroni
         (f) Spaghetti
      (2) Manufacture of dextrose, alcohol, and breakfast foods.
      (3) Livestock feed
         (a) Pasture
         (b) Grain
         (c) Hay
   b. Oats
      (1) Livestock feed
         (a) Grain
         (b) Pasture
         (c) Hay
         (d) Silage
      (2) Human food
   c. Barley
      (1) Livestock feed
         (a) Grain
         (b) Pasture
      (2) Malting purposes
      (3) Human food
   d. Rye
      (1) Grain
         (a) Flour
         (b) Whiskey
         (c) Alcohol
      (2) Pasture
      (3) Hay
      (4) Green manure crop
      (5) Cover crop

UNIT: Major Crops
TOPIC: Small Grains
(Answer Sheet continued)

4. Natural hazards to small grain production are:
    a. Plant pests
        (1) Pathogen - disease
        (2) Predator - insect
        (3) Weed - competitor for nutrients and moisture
    b. Fire
    c. Hail
    d. Moisture
        (1) Lack of
        (2) Excess of
        (3) Received at wrong time
    e. Wind

5. Leading varieties of the small grains are:
    a. Wheat
        (1) Tascosa
        (2) Bison
        (3) Kaw
        (4) Aztec
        (5) Ponca
        (6) Crockett
        (7) Comanche
        (8) Concho
        (9) Improved Triumph
        (10) Quanah
        (11) Knox
        (12) Frisco
        (13) Milam
        (14) Seabreeze
    b. Oats
        (1) Mustang
        (2) Wintok
        (3) Cimarron
        (4) Broncho
        (5) New Nortex
        (6) Moregrain
        (7) Alamo-X
        (8) Midsouth
        (9) Suregrain
        (10) Radar I
        (11) Alber
        (12) Camellia

UNIT: Major Crops
TOPIC: Small Grains
(Answer Sheet continued)

c. Barley
   (1) Kearney
   (2) Rodgers
   (3) Cordova
   (4) Harbine
   (5) Wintex
   (6) Ward
   (7) Texan
   (8) Goliad
   (9) Arivat

6. Factors to consider when selecting a variety of small grains are:
   a. Adaptability to local conditions
   b. Hardiness
   c. Maturity time
   d. Ability to produce tillers
   e. Quality of grain
   f. Stiffness of straw
   g. Disease resistance
   h. Lodge resistance
   i. Use intended for crop

7. Small grains respond very favorably to application of fertilizers in areas where the rainfall exceeds 30 inches per yield. Even in semi-arid areas some response will be observed. We need to add phosphorus to soil where this nutrient is low. We must be careful in adding nitrogen fertilizers if grain is to be harvested -- the rapid growth may increase lodging. In areas where small grains are grazed or used for hay, we generally find a very favorable response to application of nitrogen fertilizers.

8. a. Wheat
   (1) Plant in fall
   (2) Plant 30-60# per acre on dryland conditions and 60# per acre under irrigated conditions
   (3) Use grain drill

   b. Oats
   (1) Plant in fall to early spring
   (2) Plant 64-80# per acre on dryland conditions and 92# under irrigated conditions.
   (3) Use grain drill

UNIT: Major Crops
TOPIC: Small Grains
(Answer Sheet continued)

c. Barley
  (1) Plant in fall or up until February 15
  (2) Plant 48-72# per acre for dryland and 72# per acre for irrigated land
  (3) Use grain drill

9. Since most acreage in small grains is drill, there is no mechanical cultivation after the crop is sowed. Weeds are controlled with the use of chemical herbicides if needed. The land is plowed and weeds controlled by this means after the crop is harvested and before the next crop is planted.

10. a. 500# water are required to produce 1# dry matter in wheat
  b. 597# water are required to produce 1# dry matter in oats
  c. 464# water are required to produce 1# dry matter in barley

11. The method used for harvesting small grain will depend upon the intended use for the crop.
  a. Grain—Harvested by combine
  b. Pasture—Harvested by livestock
  c. Hay—Harvested with mowers, rakes, conditioners, windrowers, and balers
  d. Silage—Harvested by forage harvesters (may need to be mowed and windrowed before going through the chopper.)

12. Major small grain diseases:
  a. Wheat
    (1) Stinking Smut or Bunt
    (2) Loose smut
    (3) Black stem rust
    (4) Leaf rust
    (5) Wheat scab
    (6) Powdery mildew
    (7) Mosaic
    (8) Septoria glume blotch
    (9) Septoria leaf blotch
    (10) Take all
    (11) Foot rot
    (12) Nematode disease
    (13) Anthracnose
    (14) Ergot
    (15) Black chaff
    (16) Basal Glume Rot
    (17) Stripe rust
    (18) Flag smut

UNIT: Major Crops
TOPIC: Small Grains
(Answer Sheet continued)

- b. Oats
  - (1) Loose smut
  - (2) Covered smut
  - (3) Stem rust
  - (4) Crown rust
  - (5) Victoria blight
  - (6) Helminthosporium leaf blotch
  - (7) Powdery mildew
  - (8) Bacterial stripe blight
  - (9) Halo blight
- c. Barley
  - (1) Loose smut (A&B)
  - (2) Covered smut
  - (3) Spot blotch
  - (4) Net blotch
  - (5) Scab
  - (6) Stripe
  - (7) Leaf rust
  - (8) Stem rust
  - (9) Powdery mildew
- d. Rye
  - (1) Ergot
  - (2) Anthracnose
  - (3) Black stem rust
  - (4) Leaf rust
  - (5) Stem smut
  - (6) Scab

13. Major small grain insects are:
  - a. Wheat
    - (1) Hessian fly
    - (2) Wheat jointworm
    - (3) Wheat strawworm
    - (4) Wheat stem sawfly
    - (5) Chinch bug
    - (6) Grasshoppers
    - (7) Wireworm
    - (8) Black grain stem sawfly
    - (9) European wheat stem sawfly
    - (10) Army worm
    - (11) Greenbug
    - (12) Mormon cricket

UNIT: Major Crops
TOPIC: Small Grains
(Answer Sheet continued)

        - (13) Wheat stem maggot
        - (14) Pale western cutworm
    - b. Oats
        - (1) Greenbug
        - (2) Chinch bug
        - (3) Grain bug
        - (4) Bluegrass bill bug
        - (5) Mormon cricket
        - (6) Grasshopper
        - (7) Army worm
        - (8) Leaf hopper
    - c. Barley
        - (1) Chinch bug
        - (2) Greenbug
        - (3) Grasshopper
    - d. Rye
        - (1) Grasshopper
        - (2) Hessian fly
        - (3) Chinch bug

14. USDA grades of wheat are:
    - a. No. 1
    - b. No. 2
    - c. No. 3
    - d. No. 4
    - e. No. 5
    - f. Sample

15. Factors determining wheat grades are:
    - a. Weight
    - b. Amount of heat-damaged kernels
    - c. Amount of damaged kernels
    - d. Amount of foreign material
    - e. Amount of shrunken and broken kernels
    - f. Amount of defects
    - g. Amount of contrasting wheat classes
    - h. Amount of other wheat classes

UNIT: Major Crops
TOPIC: Small Grains
(Answer Sheet continued)

16. USDA grades for oats are:
    a. No. 1
    b. No. 2
    c. No. 3
    d. No. 4
    e. Sample

17. Factors which determine oat grades are:
    a. Weight
    b. Amount of sound cultivated oats
    c. Amount of heat-damaged kernels
    d. Amount of foreign material
    e. Amount of wild oats

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Cowpeas

1. The cowpea is a plant native to Africa and was introduced to the United States in the early 1700's. It is a warm weather plant and cannot withstand even light frost. Texas is the leading state in cowpea production in the United States.

2. Uses of cowpeas are:
   a. Hay
   b. Seed
   c. Pasture
   d. Silage
   e. Soil improvement
   f. Green manure crop

3. Natural hazards to cowpea production are:
   a. Plant pests
      (1) Pathogen - diseases
      (2) Predators - Insects
      (3) Weeds - Competitors for nutrients and moisture
   b. Fire
   c. Hail
   d. Moisture
      (1) Lack of
      (2) Excess of
      (3) Received at wrong time
   e. Temperature (frost)

4. Some important cowpea varieties are:
   a. Whippoorwill
   b. Iron
   c. New Era
   d. Brabham
   e. Groit
   f. Victor

5. Cowpeas respond to:
   a. Phosphorus fertilizers
   b. Potassium fertilizers

UNIT: Major Crops
TOPIC: Cowpeas
(Answer Sheet continued)

6. a. Planting time for cowpeas will vary from May 1 to August 1, depending upon what use is to made of the crop. They should not be planted within 90 days of the first frost of the fall.
   b. (1) When planted for seed, cowpeas should be planted in rows. A corn planter, cotton planter, or grain drill with part of the openings closed may be used.
      (2) When cowpeas are used for hay, pasture or green manuring, they should be drilled with a grain drill.
   c. (1) When cowpeas are planted in rows, 2-3 pecks per acre should be used.
      (2) When cowpeas are drilled, 5-8 pecks per acre are used.

7. Regular cultivation methods for other row crops are used for cultivating cowpeas when they are planted in rows. Little or no cultivation is done when cowpeas are drilled in.

8. Cowpeas are best adapted to warm humid areas. However, they can perform satisfactorily under relatively dry conditions. During severe droughts, seed may not develop and forage yields are greatly reduced.

9. Use of the cowpea will determine method of harvesting:
   a. Hay - mowers, rakes, hay conditioners, windrowers, balers
   b. Seed - combines (A 3/8" or 1/2" round hole sieve will need to be used. There may be added a perforated grain pan, a perforated shoe floor, a stone trap, and wide rear axle to the grain combine to better adapt it for cowpea harvesting.) It may be necessary to windrow the cowpeas and allow them to dry before threshing them with the combine.
   c. Pasture - Grazed by livestock (most commonly swine)
   d. Silage - forage harvesters

10. Diseases attacking cowpeas are:
   a. Fusarium or common wilt
   b. Root rot
   c. Charcoal rot
   d. Zonate leaf spot
   e. Red leaf spot
   f. Powdery mildew

11. Cowpea insects include:
   a. Cowpea curculio
   b. Cowpea weevil
   c. Southern cowpea weevil

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Soybeans

1. Soybeans, native to southeast Asia, is one of the oldest cultivated crops. Recorded history shows it was a major crop in China in 2838 B. C. It remained a crop of the Orient until the 1600's, when it was introduced to Europe. In 1804 it was introduced in North America but did not become a major crop until the 1900's. Because of its adaptability to different climates and mechanized agriculture in the United States, the United States now produces about 60% of the world's soybeans.

2. Soybean uses include:
   a. Industrial uses
      (1) Soap
      (2) Celluloid
      (3) Plastics
      (4) Paints
      (5) Linoleum
      (6) Candles
      (7) Glycerin
      (8) Oil Cloth
      (9) Glue
      (10) Varnish
      (11) Enamels
      (12) Rubber substitutes
      (13) Printing ink
      (14) Lubricants
      (15) Insecticides
   b. Human foods
      (1) Flour
      (2) Soy sauce
      (3) Candies
      (4) Chocolate
      (5) Margarine
      (6) Cocoa
      (7) Cooking oils
      (8) Salad oils
      (9) Vegetable milk

UNIT: Major Crops
TOPIC: Soybeans
(Answer Sheet continued)

    (10) Breakfast foods
    (11) Roasted beans
    (12) Green beans
    (13) Meat substitutes
  c. Animal feed
    (1) Hay
    (2) Silage
    (3) Pasture
    (4) Soybean oil meal
    (5) Soybean oil cake
  d. Seed production

3. Natural hazards to soybean production are:
  a. Plant pests
    (1) Pathogen - diseases
    (2) Predator - insects
    (3) Weed - competitor for nutrients and moisture
  b. Fire
  c. Hail
  d. Moisture
    (1) Lack of
    (2) Excess of
    (3) Received at wrong time

4. Soybean varieties differ by
  a. Degree of coarseness of plant
  b. Yield
  c. Number of days required for maturity
  d. Disease resistance
  e. Habit of growth
  f. Amount of shattering of seed
  g. Color, size, shape, and oil content of seed

5. Soybean varieties are classed as:
  a. Commercial use (Seed production)
  b. Forage use
  c. Vegetable use

UNIT: Major Crops
TOPIC: Soybeans
(Answer Sheet continued)

6. Factors to consider in selecting soybean varieties are:
   a. Adaptation
   b. Use which is to be made of the soybean

7. Leading soybean varieties are:
   a. Lee
   b. Lee 68
   c. Hill
   d. Bragg
   e. Bossier
   f. Semnes
   g. Davis
   h. Patterson
   i. Clark 63
   j. Wayne
   k. Hampton 266
   l. Dare
   m. Hood

8. a. Phosphorus fertilizers increase protein and phosphorus of seed
   b. Potassium fertilizers increase the oil content and improve the quality of the seed.

9. a. Soybeans should be planted between May 1 and June 15 (Soil temperature at least 65^{o}).
   b. Soybeans may be planted with
      (1) A grain drill
      (2) A corn planter equipped with soybean plates
      (3) A soybean planter
      (4) A cotton planter
   c. Rates for planting soybeans vary 40-120 pounds per acre depending upon:
      (1) Size of seed
      (2) Purpose for which they are being grown
      (3) Method of planting
      (4) Percentage of germination of seed
      (5) Fertility and moisture content of soil
      (6) Row spacing

UNIT: Major Crops
TOPIC: Soybeans
(Answer Sheet continued)

10. Rotary hoes, weeders, and harrows are recommended while plants are small. Later, regular row cultivation is used.

11. It takes 774 pounds of water to produce one pound of dry matter in soybeans. They need 20-30 inches of water per year.

12. Soybeans are harvested according to their use:
    a. Seed - by combine
    b. Hay - by mowers, rakes, conditioners
    c. Silage - by forage harvesting
    d. Pasture - by grazing

13. Major insects attacking soybeans are:
    a. Velvetbean caterpillar
    b. Bean leaf beetle
    c. Mexican bean beetle

14. Minor soybean insects are:
    a. Japanese beetle
    b. Cutworms
    c. Wireworms
    d. White grubs
    e. Grasshoppers
    f. Leafhoppers
    g. Army worms

15. Diseases attacking soybeans are:
    a. Bacterial blight
    b. Soybean mosaic
    c. Downy mildew
    d. Frogeye leafspot
    e. Brown stem rot
    f. Stem canker

16. USDA grades for soybeans are:
    a. No. 1
    b. No. 2
    c. No. 3
    d. No. 4
    e. Sample

UNIT: Major Crops
TOPIC: Soybeans
(Answer Sheet continued)

17. Factors which determine grade for soybeans are:
    a. Weight
    b. Moisture content
    c. Amount of splits
    d. Amount of heat-damaged kernels
    e. Total amount of damaged kernels
    f. Amount of foreign material
    g. Amount of brown, black, and/or bicolored soybeans in yellow or green soybeans

Answer Sheet
for
CROP FARM EMPLOYEE

UNIT: Major Crops

TOPIC: Alfalfa and Clover

1. Alfalfa is native to Central Asia. It was first cultivated in Iran. By 490 B. C. it had spread to Greece and from there it spread through Europe. Early Spanish explorers carried it to South and Central America. It was first raised in the United States, in Georgia in 1736. It did not really succeed until around 1850 when varieties from Chile were carried to California.

2. Alfalfa and sweet clovers may be used for:
   a. Hay
   b. Pasture
   c. Silage
   d. Seed

3. Natural hazards to alfalfa and sweet clover production are:
   a. Plant Pests
      (1) Pathogen - diseases
      (2) Predator - insects
      (3) Weed - competitors for nutrients and moisture
   b. Fire
   c. Hail
   d. Wind
   e. Moisture
      (1) lack of
      (2) excess of
      (3) received at wrong time

4. Major varieties of alfalfa are:
   a. The USDA Survey reported a list of 77 varieties. Most of the varieties that were reported since 1940 are still being used.
   b. Before 1940
      (1) Grimm
      (2) Cosack
      (3) Baltic
      (4) Meeker Baltic
      (5) Hardigan
      (6) Canadian Variegated
      (7) Ladak (Still rather popular)

UNIT: Major Crops
TOPIC: Alfalfa and Clover
(Answer Sheet continued)

- c. From 1940-1955
  - (1) Ranger
  - (2) Atlantic
  - (3) Buffalo
  - (4) Narragansett
  - (5) Williamsburg
  - (6) Caliverde
  - (7) Vernal
  - (8) Lahontan
  - (9) Du Puits
- d. Since 1955
  - (1) Moapa
  - (2) Zia
  - (3) Cody
  - (4) Teton
  - (5) Travois

5. Factors to consider when selecting a variety of alfalfa or sweet clover are:
   - a. Use (pasture, hay, silage, seed, etc.)
   - b. Disease resistance
   - c. Insect resistance
   - d. Yield

6. The 3 nutrients most required by alfalfa are:
   - a. Phosphorus
   - b. Potassium
   - c. Calcium (lime)

7. a. Fall seedings of alfalfa are most successful.
   - b. Alfalfa should be sowed at a rate of 15-20 pounds per acre by an alfalfa drill, grain drill, grass drill, or cultipacker-seeder.

8. Alfalfa should be cultivated when:
   - a. The soil is compacted by grazing or machinery
   - b. Irrigation or overflows have left silt deposits

9. Alfalfa should be irrigated:
   - a. Once per cutting when soil moisture readily penetrates to a depth of 4-6 feet
   - b. Two or three times per cutting on light soils, where moisture does not readily penetrate

UNIT: Major Crops
TOPIC: Alfalfa and Clover
(Answer Sheet continued)

10. Alfalfa and sweet clovers are harvested several ways, depending upon the use:
    a. Hay - Mowers, rakes, conditioners, windrowers, and balers
    b. Pasture - Grazed by livestock
    c. Seed - Combine with special sieves
    d. Silage - Forage harvesters

11. a. The chief types of alfalfa disease are:
        (1) Root rots and wilts
        (2) Bacterial leaf diseases
        (3) Seedling diseases
    b. The chief alfalfa insects are:
        (1) Spotted alfalfa aphid
        (2) Pea aphid
        (3) Grasshoppers
        (4) Three-cornered alfalfa hopper
        (5) Alfalfa caterpillar
        (6) Lygus bugs
        (7) Thrips

12. For best-quality alfalfa hay, the hay should be leafy, fine stemmed, and green. It should also be free of foreign materials, such as weeds and grasses. To insure top quality hay, the alfalfa must be cut at the proper stage of growth, properly cured, and come from pure dense stands of alfalfa.

13. Sweet clovers are native to Western Asia and Europe. They were first brought to the United States in the early 1700's. At first they were used mainly as a soil improving crop but gradually became a field crop also. It is not tolerant of acid soils.

14. Major species of sweet clovers are:
    a. The annual white-flowered sweet clover, melilotus alba annua
        (1) Hubam
        (2) Floranna
    b. The annual yellow-flowered sweet clover, melilotus indica
    c. The biennial white-flowered sweet clover, melilotus alba
        (1) Evergreen
        (2) Spanish
    d. The biennial yellow-flowered sweet clover
        (1) Madrid

UNIT: Major Crops
TOPIC: Alfalfa and Clover
(Answer Sheet continued)

15. Nutrients required in greatest quantity by sweet clover are:
    a. Calcium (lime)
    b. Phosphorus

16. a. Sweet clovers are planted in the spring or fall depending upon location in the state.
    b. Planting rates vary from 2-3 pounds per acre when planted in rows to 15 pounds per acre when drilled.

Topic Test
on
OPPORTUNITIES IN FARMING

Student: ____________________ School: ____________________

Date: ____________________ Score: ____________________

Part I

Complete the following statements by filling in the correct word or words:

1. The largest industry in the United States is ____________________.
2. There are approximately ______________ in the farming business.
3. The total farm assets equal about ______________ billion dollars.
4. Farms are ______________ in size.
5. The farm population is ______________ each year.
6. The average farmer in the 1800's could produce enough food for himself and ______________ other people.
7. The pioneer farmer found ______________ soil to produce his food and fiber.
8. The pioneer farmer experienced fewer problems with ______________ and ______________ in crop farming.
9. About ___________ million people are employed in the agricultural industry.
10. Five of the major agricultural occupations are:

    a. ____________________
    b. ____________________
    c. ____________________
    d. ____________________
    e. ____________________

UNIT: Introduction
TOPIC: Opportunities in Farming
(Topic Test continued)

Part II

Place a T beside the true statements and an F beside the false statements:

_____ 1. The USDA was formerly a division of the U. S. Patent Office.

_____ 2. There has been an increase in crop production and a decrease in labor input.

_____ 3. Mechanical harvesting is not used to harvest hard-to-pick fruit crops.

_____ 4. Agriculture is the second largest industry in the U. S.

_____ 5. There are very few jobs available for the graduates of agricultural colleges.

_____ 6. Land-grant universities graduate only about 3,500 students in the colleges of agriculture.

_____ 7. Farms have become fewer in number yet larger in size and more productive.

_____ 8. One out of every three people will be exposed to some type of agriculture experience during their working career.

_____ 9. About a quarter century ago agriculture was thought of as tilling the land and growing crops.

_____ 10. One farmer can produce enough food for himself and only 10 other people.

Topic Test
on
HISTORY OF FARMING

Student: ____________ School: ____________

Date: ____________ Score: ____________

Write True beside the statements that are true and False beside the statements that are false.

_____ 1. As the percentage of farmers in the population has decreased, the demands upon farmers have increased.

_____ 2. The small family farm was never important in the United States.

_____ 3. Parity is easy to define.

_____ 4. Industry can adjust to economic changes quicker and easier than agriculture.

_____ 5. The farmer of the future must be broadly educated and be familiar with the fundamentals of the sciences involved in profitable production and efficient marketing.

_____ 6. Crop husbandry began about 10,000 years ago.

_____ 7. Wheat and barley have been grown for over 7,000 years in Asia.

_____ 8. Corn and potatoes were among the major cultivated plants discovered in the New World.

_____ 9. Crop farming began about 5,000 years ago.

_____ 10. Hand-labor cultivation began in North America about 100 B.C.

_____ 11. Corn pollen was first discovered 60,000 years ago in Europe.

_____ 12. There is more pasture land in the United States than crop land.

_____ 13. Less than one-fourth of the land in Texas is used to produce field crops.

Topic Test
on
FARMING AS A SCIENCE

Student: ______________________ School: ______________________

Date: ______________________ Score: ______________________

Fill in the blanks with the correct word or words.

1. Agriculture is defined as "____________________________________ ____".
2. ____________ million workers are supplied raw materials through modern agriculture.
3. American agriculture has made the greatest advancement in the past _____ years.
4. The first great step in technical agriculture during the twentieth century was the replacement of _______________ power with ____________ power.
5. Destroying weeds with ______________ may eliminate most crop cultivation.
6. There has been a _________________ in the farm labor force.
7. In the 1950's an increased use of irrigation practices caused an increase in __________________ practices.
8. About _________ percent of all scientists are working in life sciences and agriculture.
9. All kinds of foods can be purchased out of _____________________.
10. Through new technology the farmer can continue to ____________ production.
11. Growth regulators are most widely used in ____________ (type of production).
12. _______________ was one of the first chemicals banned by the ecology movement.
13. Some technical changes that have transformed cotton production are: _______________, _________________, and _______________.

Topic Test
on
ECONOMICS OF A FARM ENTERPRISE

Student: ____________________ School: ____________________

Date: ____________________ Score: ____________________

Part I:

Write True beside the statements that are true and False beside the statements that are false:

_______ 1. If an enterprise cannot be made profitable it should be dropped.

_______ 2. All enterprises on the farms pay their own way.

_______ 3. Many things should be considered before adding a new enterprise.

_______ 4. All enterprises that are not profitable should be dropped.

_______ 5. A farmer should go into new enterprises on a large scale.

_______ 6. Some losing enterprises on a farm might be made profitable.

_______ 7. Records are only one sure way to determine whether an enterprise is profitable.

_______ 8. If the supply of products exceeds the demand, the prices are usually high.

_______ 9. Wars are always affecting the price of agricultural products.

_______10. A balanced farm program may include more than two enterprises.

_______11. The most important factor in determining the type of crop enterprise to initiate is money.

Part II:

Completion

1. The United States is an ______________ high income nation.

UNIT: Introduction
TOPIC: Economics of a Farm Enterprise
(Topic Test continued)

2. The frontier agriculturalist experienced an abundance of land and a ____________________ of labor.

3. The ________________ market represented the primary link between non-farm and farm economies.

4. United States growth in agriculture production depends upon demands in Western Europe, Japan, and food for __________________ countries.

5. Broiler ______________ have been instrumental in replacing farm flocks for meat.

6. Older terminal agricultural markets have been eliminated due to trucking replacing the _____________________.

7. An act was passed in _______ to establish agricultural experiment stations in each state.

Topic Test
on
FARMING IN THE UNITED STATES

Student:________________________ School:________________________

Date:________________________ Score:________________________

Write True beside the statements that are true and False beside the statements that are false.

_______1. 30.9% of the land area of the United States is devoted to crop production.

_______2. The United States Census Bureau predicts that the population of the United States will continue to increase for many years.

_______3. If the population does increase as predicted, the farmer will need to decrease his crop production.

_______4. If an increased production of food is needed, the crop producer will need to be well-informed about modern farm technology.

_______5. There will be more acres of land available for crop production in the years to come.

_______6. Farmers, because of their management practices, are causing most of the decrease in useable farmland.

_______7. Cotton and corn are native to the United States.

_______8. Most of the land suitable for hay and grazing is found in the Mideastern states.

_______9. The largest percent of land in the United States is forest land.

______10. The farmer in the United States could double production in the next 10 years.

Topic Test
on
FARMING IN TEXAS

Student: ______________________ School: __________________________

Date: _________________________ Score: ___________________________

Write True beside the statements that are true and False beside the statements that are false:

_______ 1. Texas has an approximate income of $1,361,000 annually from crops produced.

_______ 2. Texas farmers use approximately $2,000,000,000 in services and supplies each year.

_______ 3. The Texas Almanac is a good source of information about Texas agricultural products.

_______ 4. Texas is divided into approximately 15 major crop growing and crop marketing districts.

_______ 5. The Texas Department of Agriculture is not a good place to secure information about farming in Texas.

_______ 6. Reports are made semiannually from the reporting districts.

_______ 7. Cotton is grown as one of the major crops in all districts.

_______ 8. Statistics on crop production can be secured from more than one source.

_______ 9. The Edwards Plateau produces cotton and wheat.

_______10. Texas is a state that produces at least 10 of the major crops that are used for food and fiber in the United States.

Topic Test
on
FARMING ORGANIZATIONS AND FARM SERVICE AGENCIES

Student:______________________________ School:______________________________

Date:________________________________ Score:_______________________________

Part I: Fill in the following blanks to make true, complete sentences:

1. The Farm Bureau was established to aid the farmer to get better ______________, ______________, ______________, ______________, and ______________.

2. The Grange works with the following three institutions:
   a. ____________________ b. ____________________
   c. ____________________

3. The Farmer's Union helps the farmer through ______________, ______________, and ______________.

4. A cooperative may be formed by ______________ members or more.

5. The Cooperative Marketing Act became a law in ____________ (year).

Part II: True or False

________1. The Federal meat and poultry inspection service is the only type of inspection performed by the U.S.D.A.

________2. The Agricultural Research Service is not concerned with breeding better plants and animals.

________3. The Agriculture Stabilization and Committee in a county makes loans to farmers.

________4. The Soil Conservation Service conducts watershed work.

________5. The Farmers Home Administration is an agency to make loans to farmers.

________6. Federal Crop Insurance was originally established to protect the farm from soil damage by erosion.

UNIT: Introduction
TOPIC: Farm Organizations and Farm Service Agencies
(Topic Test continued)

_______7. The Extension Service is basically a program of education.

_______8. Vocational Agriculture is not considered a service program to help the farmer with his problems.

Topic Test
on
KEEPING FARM RECORDS

Student:____________________ School:____________________

Date:____________________ Score:____________________

Write True beside the statements that are true and False beside the statements that are false:

________1. The posting of small items in the expense ledger should be made monthly.

________2. The Internal Revenue Service will take the farmer's word for all expenses incurred.

________3. Records should be used for improvement.

________4. Records should be kept on the farm as a whole.

________5. Income should be recorded only when as much as $10.00 is received.

________6. Records should be brought up to date each quarter, every three months.

________7. All records should be made alike for all farmers.

________8. There are almost as many record keeping systems as there are farmers.

________9. An inventory at the beginning and end of the year is necessary in a record keeping program.

________10. Records can be used as an instrument to expand crop programs.

________11. It is not necessary to keep records when participating in crop improvement programs.

________12. The income tax forms do not require an inventory and depreciation.

________13. The USDA agencies do not require records when a farmer is participating in the program or programs.

UNIT: Farm Record
TOPIC: Keeping Farm Records
(Topic Test continued)

_______14. One of the main pitfalls in keeping records is not keeping records up to date.

_______15. There is a standard method used by all farmers in record keeping systems.

Topic Test
on
USING RECORDS IN FARM MANAGEMENT

Student:______________________ School:______________________

Date:______________________ Score:______________________

Part I: Write True beside the statements that are true and False beside the statements that are false.

________1. Records should be thrown away at the end of each year.

________2. Farming without records to review is like looking at a clock without hands.

________3. Once a month is often enough to list expenses and income.

________4. A farmer should keep the kind of records that will meet his needs.

________5. The right kind of records will give the answers to a lot of questions.

________6. A man should farm a few years to get experience before keeping records.

________7. The total profit is all the farmer is interested in.

________8. Small items and small jobs like spraying should not be recorded.

Part II: Answer the following questions.

1. Good records are necessary for farms using herbicides because... ?

2. It is important to have fields square or rectangular because... ?

3. Most farmers try to farm:
    A. At a loss
    B. For fun
    C. For profit
    D. Because they cannot do anything else

4. Maps may be used to:
    A. Keep fertilizer records
    B. Keep herbicide records

UNIT: Farm Records
TOPIC: Using Records in Farm Management
(Topic Test continued)

C. Farm planning
D. None of the above
E. All of the above

Topic Test
on
PROPER USE OF MACHINERY AND EQUIPMENT

Student:__________________________ School:__________________________

Date:______________________________ Score:__________________________

Part I:
Write True beside the statements that are true and False beside the statements that are false:

________1. It is very important that the tractor and machinery operator follow safety practices that will prevent accidents.

________2. Hazards to the safety of the tractor and machinery operator should be corrected to prevent serious accidents.

________3. Farming is not one of the most hazardous industries.

________4. Tractor and machinery operating and service manuals should be studied carefully.

________5. A tractor operator need not be concerned with transporting equipment on the highway as no special precautions are needed.

________6. If a farm tractor is operated correctly, it should last the farmer many years.

________7. Overloading equipment engines will lengthen their useful life.

________8. The farm division of the National Safety Council has developed rules for safe tractor operation.

________9. Most farm accidents occur because equipment and machinery operators are too careful when operating equipment and machinery.

_______10. Owner's and Operator's Manuals should be thrown away as soon as the farmer reads them once.

_______11. If the tractor skids sideways with heavy loads, front end weight is necessary.

_______12. If ground speed is doubled, the chance of overturning is doubled.

UNIT: Farm Machinery - Maintenance and Operation
TOPIC: Proper Use of Machinery and Equipment
(Topic Test continued)

_______13. A tractor may overturn if one rear wheel hits an object at 8 miles per hour.

_______14. The safest way to park a tractor on a downgrade is to put it in gear.

_______15. The drawbar should be over 18 inches high when towing heavy loads attached to it.

_______16. When driving tractors around slopes the wheels should be spaced close together.

_______17. In order to get a heavy load moving, the tractor clutch should be engaged quickly.

_______18. It is considered a safe practice to pull heavy loads by the axle.

_______19. A good way to change positions when operating a tractor is to stand on the platform.

_______20. The SMV symbol is mounted at both front and rear of the tractor.

Part II:
List all the safety hazards shown on the "What's Wrong" picture.

Topic Test
on
MAINTENANCE OF POWER MACHINERY

Student:____________________ School:____________________

Date:____________________ Score:____________________

Part I: Write True beside the statements that are true and False beside the statements that are false.

________1. In order to keep machinery maintenance cost low, the tractor operator must do more than just drive the tractor.

________2. There are many daily routine checks and inspections of machinery that must be carried out.

________3. A good tractor operator must be an expert mechanic.

________4. Servicing the air cleaner is one of the 10 hour service jobs.

________5. The tractor should be running while checking the oil level.

________6. Present-day tractors use forced circulation cooling systems.

________7. To be a good on-the-job repairman, you should be able to discover any trouble early and correct it promptly.

________8. The tractor operator should never attempt to tune up his tractor.

________9. There is no particular need to have an engine hour meter.

_______10. Improper and insufficient lubrication is a major cause of farm machinery wearing out.

_______11. All modern well-designed farm machinery has the screw-down low pressure type grease fittings.

_______12. You cannot reduce maintenance cost if you do not know what they are.

_______13. Records of servicing times and dates are very important in maintaining maximum efficiency of equipment.

UNIT: Farm Machinery - Maintenance and Operation
TOPIC: Maintenance of Power Machinery
(Topic Test continued)

_______14. It is a difficult job to clean the sediment bowl on most tractors.

_______15. Internal combustion engines that use heavy fuels operate at the same temperature as gasoline burning engines.

Part II: Answer the following questions:

1. When is a tire properly inflated?

2. Why is liquid used in tires, and what is the fill recommendation?

3. List the major service areas found on power machinery.

4. What care should be taken to receive good service from belt and chain drives?

Topic Test
on
MAINTENANCE OF EQUIPMENT

Student:______________________ School:______________________

Date:______________________ Score:______________________

Write True beside the statements that are true and False beside the statements that are false:

________1. A regular servicing and maintenance schedule will keep farm equipment maintenance to a minimum.

________2. Farm equipment service manuals are excellent sources of information for servicing and repairing farm equipment.

________3. If the operator knows his equipment, the necessary adjustments and servicing can be carried out quickly.

________4. Regular and thorough oiling is one of the major causes of equipment breakdowns.

________5. A farm shop service area on the farm is of little value to the skilled equipment operator.

________6. Farm equipment properly sheltered from weather will usually require less maintenance.

________7. Adjusting the coulter on a moldboard plow requires special skills of the operator.

________8. The operator should keep bolts and nuts tight on his equipment.

________9. If tractor steering is difficult, one should check his plow adjustments.

________10. Maintenance can be summed up as including cleaning, adjusting, and lubricating equipment.

________11. There is no need to take safety precautions with grease and oils in the equipment repair portion of the farm service shop.

________12. A lubricating chart should be available while lubricating combines, corn pickers, hay balers, etc.

UNIT: Farm Machinery - Maintenance and Operations
TOPIC: Maintenance of Equipment
(Topic Test continued)

_______13. The economical management of farm equipment is a most vital part of the operator's job.

_______14. If maintenance cost is not controlled, the cost per unit of production will go up.

_______15. Accurate cost records on equipment repairs are a vital part of equipment management.

Topic Test
on
MAINTENANCE OF FARM STRUCTURES AND EQUIPMENT

Student:__________________________ School:__________________________

Date:____________________________ Score:___________________________

Write True beside the statements that are true and False beside the statements that are false.

________1. For a farm to operate efficiently, it should have adequate structures and equipment.

________2. To be efficient, all farms should have a lot of structures and equipment.

________3. Most farm equipment is operated above its rated capacity.

________4. Farm structures should be erected with fire safety in mind.

________5. Very few farm structures were built for the utmost in convenience.

________6. Farm structures should be well planned before being erected.

________7. Most farmers plan and erect the structures they feel are needed.

________8. Appearance should be considered first in the building of farm structures.

________9. Canvas-duck is more durable than plastic for equipment cover.

_______10. It is impossible to align machinery-storage buildings to get protection from blowing rains.

_______11. Before constructing a storage building, the machinery should be measured for space it will require.

_______12. Crankcase or transmission oil will prevent rust over six months if exposed to weather conditions.

_______13. There are solvents that will protect equipment from rust as long as a 12-month period.

UNIT: Farm Structures and Equipment
TOPIC: Maintenance of Farm Structures and Equipment
(Topic Test continued)

_______14. Over a period of years it costs less per square foot to use a tarpaulin than to build a shed.

_______15. A wood or frame structure costs about the same to maintain as a steel structure.

Topic Test
on
BUILDING AND MAINTAINING FARM FENCES

Student:____________________ School:____________________

Date:____________________ Score: ____________________

Part I: Indicate True or False beside each statement.

________1. Fence building has not changed.

________2. Good fences make good neighbors.

________3. Good planning of fences is essential in order to get the most efficient use of all land.

________4. Some temporary fences are charged with electricity.

________5. Electrically charged fences are most effective against sheep and goats.

________6. Batteries for an electric fence last about 6 months.

________7. Nailing wire to a tree makes the fence last longer.

________8. Clearing the fence line should be done first.

________9. Special attention should be used in setting corner and brace posts.

Part II: Fill in the blanks with the correct word or words.

1. The three most common kinds of fences are ____________ ____________, ____________ ____________, and ____________________.

2. The most common sizes of barbed wire are ____________ and ____________.

3. ____________ coated steel wire has a longer life than ____________ coated wire.

4. A well constructed barbed wire fence will exert a ____________ pound pull.

UNIT: Farm Structures and Equipment
TOPIC: Building and Maintaining Farm Fences
(Topic Test continued)

5. Anchor posts should be set about ____________________ feet deep.

6. Cold temperature will ____________________ the wire.

Topic Test
on
IMPORTANT FACTORS AFFECTING THE CHOICE OF CROPS

Student:______________________________ School:____________________________

Date:________________________________ Score:_____________________________

Part I: Indicate True or False beside each statement.

________1. Selecting a crop is simple and easy.

________2. Choosing the right crop and right variety for the locality is the first step in successful crop production.

________3. Distribution of rainfall is not important.

________4. Local demand and nearness to market play a part in the choice of crops.

________5. Crop varieties differ in many ways.

________6. In some cases it is good for the whole community to grow the same variety.

________7. The use of the crop does not influence the selection of the crop.

________8. The planting of good seed assures a good crop.

________9. Obnoxious weeds can be brought in with seed.

Part II: Complete the following statements by filling in the correct word or words:

1. At the beginning of the Twentieth Century, there were ______________ methods of crop selection.

2. Five factors that influence crop selection are: ______________, ______________, ______________, ______________, and ______________.

3. Pedigree selection is referred to as ________________ ________________ selection.

UNIT: Crop Selection
TOPIC: Important Factors Affecting the Choice of Crops
(Topic Test continued)

4. Farmers depend upon plant breeders and ____________________ to improve crop varieties.

5. ____________________ selection entails detailed record keeping practices.

Topic Test
on
IMPORTANCE OF A GOOD SEEDBED

Student:____________________________ School:____________________________

Date:______________________________ Score:_____________________________

Part I: Indicate True or False beside each statement:

________1. All seedbeds should be prepared alike.

________2. A good seedbed is prepared to give the young plant the best possible start in life.

________3. All seedbed preparation should be made in the spring.

________4. All seed should be planted on the level ground.

________5. Plowing is a part of seedbed preparation.

________6. Small seeds need a finer seedbed than a crop that has larger seeds.

________7. As a general rule, the seedbed should be fine and fairly firm.

________8. The cheapest time to kill weeds is before the crop is planted.

________9. Some seedbeds are prepared in the spring to reduce erosion.

_______10. Fall plowing permits the turning under of crop residue and hastens its decay.

Part II: Fill in the blanks with the correct word or words:

1. A good seedbed will furnish a good growing medium for the tiny ____________ ____________________.

2. Nematodes are treated with ___________________.

3. Plant residue should be ____________________ in the soil.

4. A good seedbed should have adequate _____________, proper _____________, and free of ______________.

Topic Test
on
ROW CROP SEEDBED PREPARATION

Student:________________________ School:________________________

Date:________________________ Score:________________________

Write True beside the statements that are true and False beside the statements that are false:

________1. The methods of seedbed preparation have changed very little in the past two decades.

________2. The equipment used to loosen and break the soil up to 36 inches deep is called primary tillage equipment.

________3. Tractor-drawn disc plows are trailing, semi-mounted, and integral types.

________4. The disc plow was developed to reduce friction by making a rolling bottom.

________5. The same types of equipment should be used on all types of soil for seedbed preparation.

________6. New and improved types of equipment are being developed for seedbed preparation all of the time.

________7. Insects and diseases do not live in crop residues.

________8. A good seedbed is finely pulverized, firm, but loose and mellow, and covered with trash and weeds.

________9. In areas of low rainfall, the soil should be thoroughly worked just prior to planting.

_______10. In areas of strong winds and sandy soils, crop residues may be left standing to prevent wind erosion.

_______11. A good seedbed should be about two or three inches deep.

_______12. Crop residue is the part of the crop left in the field after harvesting.

UNIT: Land Preparation
TOPIC: Row Crop Seedbed Preparation
(Topic Test continued)

_______13. Primary tillage equipment should be pulled as fast as the tractor will run, so one can get through in a hurry.

_______14. Harrow type plows are used to break clods and pulverize the soil.

_______15. One of the main reasons for tillage is to pack the soil with the tractor, so better soil contact is made by the seed.

Topic Test
on
BROADCAST CROP SEEDBED PREPARATION

Student: ______________________ School: ___________________________

Date: _________________________ Score: ____________________________

Part I:
Indicate True or False beside each statement:

_______ 1. All seedbed preparation should be done in the fall.

_______ 2. Seedbed preparation depends on the amount of wind that blows in an area.

_______ 3. Seedbed preparation should be considered only if the fields are trashy and full of weeds.

_______ 4. The type and amount of seedbed preparation depends mainly on the climatic factor in a given locale.

_______ 5. The preparation of the seedbed has no effect on the amount of moisture left in the soil.

_______ 6. Small clumps of soil, clods, are not desirable in small grain seedbeds.

_______ 7. In many instances deep plowing or breaking is desirable in broadcast crop seedbed preparation.

_______ 8. Land that is left flat is more susceptible to erosion than land that is left in furrows.

_______ 9. Weed control is only of minor importance to a small grain farmer.

_______10. Most broadcast crops are planted with a grain drill.

Part II:
Completion

1. The high plains in the United States is predominately a ________________ producing area.

UNIT: Land Preparation
TOPIC: Broadcast Crop Seedbed Preparation
(Topic Test continued)

2. The ________________ plow will leave a lot of stubble on the ground.

3. Small grain crops are usually ________________ planted.

4. In areas where wind erosion is a problem a small amount of ____________ soil is mixed with the topsoil.

5. In the blackland and grand prairies small grains grown are planted in ________________ land situations.

6. A good seedbed is formed by ________________ before and after plowing.

7. A poor seedbed is formed by plowing and not __________________.

8. Seedbed preparation should begin soon after the crop is _____________.

Topic Test
on
PERMANENT PASTURE PREPARATION

Student:____________________ School:____________________

Date:____________________ Score:____________________

Write True beside the statements that are true and False beside the statements that are false:

________1. Pasture plants need no land preparation.

________2. Most pasture plants need a firm, mellow seedbed.

________3. Some pasture land has to be cleared of trees, brush, and stumps before the land is prepared.

________4. A well prepared seedbed will firm up during the winter and need very little work in the spring.

________5. Destroying the established vegetation is not necessary in preparing a seedbed.

________6. Limestone and fertilizer should be mixed with topsoil.

________7. Seedbed preparation will depend on location, season, soil type, moisture, kind of plant, and topography of the soil.

________8. A press wheel, roller, or cultipacker will reduce the germination of grass seed.

________9. Row planting is preferred in establishing bermuda grass.

________10. Common bermuda will cover an area without soil conditioning, if scattered plants are present.

________11. The top inch of soil must be moist about two weeks or more if grass seedings become established.

________12. The best time to sprig coastal bermuda is when it is dormant?

________13. Fertilizer should always be drilled in with the grass seed in a well prepared seedbed.

UNIT: Land Preparation
TOPIC: Permanent Pasture Preparation
(Topic Test continued)

_______14. Bermuda grass will grow faster and reduce the weed problem if the ground is sparsely sprigged.

_______15. Fertility of the soil is considered a critical factor when planting common bermuda.

Topic Test
on
LAND MANAGEMENT PRACTICES

Student: ______________________ School: __________________________

Date: ________________________ Score: __________________________

Part I: Fill in the blanks.

1. The agency responsible for developing and carrying out soil erosion and water conservation practices is known as the ____________ __________ _________________________.
2. Nature protects the soil by covering it with ___________________.
3. Sloping land requires protection against ___________ and ___________.
4. The two most commonly used pieces of equipment for land leveling are ____________________________ and ______________________.
5. About _______________ million acres of the present crop land should be drained.
6. All but ________________ states report some type of artificial drainage.
7. ______________________ drains have been used since 1885.
8. The simplest and cheapest method of draining flat lands is by ____________ _________________________.

Part II: Write True beside the statements that are true and False beside the statements that are false.

______ 1. Leveling is a good practice on irrigated land.

______ 2. Drainage-by-beds is best adapted to flat land.

______ 3. Lakes can be drained by vertical drainage.

______ 4. One way to reduce erosion is to provide a cover to take-in the rainfall.

UNIT: Land Preparation
TOPIC: Land Management Practices
(Topic Test continued)

______ 5. Soils do not always need a way of infiltrating soil moisture.

______ 6. Land leveling is usually necessary each year on land that is flood irrigated.

______ 7. In most cases, leveled land is easier farmed.

______ 8. It is not necessary to bed land (form rows) the same height after the land is leveled.

Topic Test
on
INTRODUCTION

Student:____________________ School:____________________

Date:____________________ Score:____________________

Answer the following questions:

1. When did the chemical fertilizer industry have its beginning?

2. In what year was commercial fertilizer first made in the United States?

3. Where was commercial fertilizer first produced in the United States?

4. Approximately how many tons of fertilizer were used by the nation's farmers in 1977?

5. What type of commercial fertilizer was first produced in the United States?

Write True beside the statements that are true and False beside the statements that are false:

________6. The Middle Atlantic States were the biggest users of commercial fertilizers in 1977.

________7. The Indians were using fish as a fertilizer when the first settlers arrived in the United States.

________8. Abraham Lincoln has been credited with making the following statement: "We should return to the soil the plant food which is removed by crops."

________9. The state fertilizer laws and regulations were adopted to protect the consumer and honest manufacturers.

________10. If pesticide chemicals are added to a bag of fertilizer, this information must be shown on the bag.

UNIT: Fertilizers
TOPIC: Introduction
(Topic Test continued)

_______11. The individual cannot send a sample of purchased commercial fertilizer to the Feed and Fertilizer Control Service in College Station for analysis.

_______12. Fertilizers are among the most important chemicals used by farm operators today.

_______13. Blended fertilizers are made by mixing the different materials at the time of delivery.

_______14. The three primary nutrients found in analysis 10-10-10 fertilizer mix are nitrogen, phosphorus, and sulphur.

_______15. Most commercial fertilizers are sold in the mixed form. (complete fertilizer)

Topic Test
on
PLANT NUTRIENTS AND THEIR FUNCTIONS

Student: ______________________ School: ___________________________

Date: _________________________ Score: ____________________________

Complete the following statements by filling in the correct word or words:

1. Plant nutrients are grouped into the ________________, ______________ and micro-nutrient groups.

2. Lime is grouped within the ________________ group of nutrients.

3. Dark green color, induced rapid growth, increased yield of fruit are the results of application of ______________________ to corn plants.

4. Purpling of leaves of corn plants is an indication of _____________ deficiency.

5. Nitrogen is used by plants in the form of _______________ or ____________.

6. P_2O_5 and K_2O indicates __________________ and _____________ in fertilizers.

7. To add calcium to the soil, an application of ________________ is necessary.

Write True beside the statements that are true and False beside the statements that are false:

_______ 8. Pure nitrogen must be mixed with other elements before it can be used as a plant food.

_______ 9. 36,000 tons of nitrogen are found in the atmosphere over every acre and can be utilized by synthetic or plant nitrogen fixation processes.

_______10. Without phosphorus, life can still exist.

_______11. Phosphorus in fertilizers is in the form of phosphoric oxide (P_2O_5).

_______12. Large amounts of the micro plant nutrients are required for plant growth.

UNIT: Fertilizers
TOPIC: Plant Nutrients and Their Functions
(Topic Test continued)

_______13. A soil test is one of the best ways to determine plant food deficiencies.

_______14. A sickly yellowish green color, dwarfed growth, and firing up of leaves is an indication of nitrogen deficiency.

_______15. This country is fortunate to have 2/3 of the world's known supply of phosphorus.

_______16. Profits will remain the same if some of the secondary nutrients are short.

_______17. Plant yields usually go higher than the most deficient plant nutrient.

Topic Test
on
TYPES OF FERTILIZERS
(ADVANTAGES AND DISADVANTAGES OF EACH)

Student: ______________________ School: ______________________

Date: ______________________ Score: ______________________

Write True beside the statements that are true and False beside the statements that are false:

_______ 1. The first step in making anhydrous ammonia is the conversion of atmospheric nitrogen to ammonia (NH_3).

_______ 2. There are 16 known elements needed for normal plant growth.

_______ 3. Dry-mixed fertilizers are made by mixing selected plant foods to get certain quantities and ratios of plant nutrients.

_______ 4. Granulated dry-mixed fertilizers are seldom used by crop farmers today.

_______ 5. Increased efficiency in the use of machinery and labor has been an important point in the greater use of liquid fertilizers.

_______ 6. Anhydrous ammonia is always in the gaseous state.

_______ 7. Green manure crops are grown to add nutrients to the soil.

_______ 8. Gaseous fertilizers are not considered dangerous to store.

_______ 9. The management of crop residue will not affect the level of organic matter that can be maintained.

_______10. The first effect of adding raw organic materials to a soil is to rapidly increase the number of soil organisms due to an abundance of energy-producing materials.

_______11. A poorly fertilized green manure crop will produce a greater amount of organic matter than a crop heavily fertilized.

UNIT: Fertilizers
TOPIC: Types of Fertilizers (Advantages and Disadvantages of Each)
(Topic Test continued)

_______12. Legume green manure crops usually add more nitrogen to the soil than they take from it.

_______13. Ammonium nitrate contains 33.5% nitrogen.

_______14. Superphosphate contains five plant food nutrients.

_______15. Urea contains some phosphorus and potassium.

Topic Test
on
APPLYING FERTILIZER

Student:________________________ School:________________________

Date:________________________ Score:________________________

Write True beside the statements that are true and False beside the statements that are false:

_______1. No specific methods of applying fertilizers are necessary when fertilizing crops.

_______2. The method of applying fertilizer to the soil is influenced by the type of soil, climatic conditions, crops grown, and type of fertilizer being applied.

_______3. Barnyard manure is usually applied in bulk on top of the soil.

_______4. The addition of superphosphate commercial fertilizer to barnyard manure has no particular advantage.

_______5. Dry forms of fertilizers are usually placed in the row 1-2" to one side and 1-2" below the band of seed.

_______6. Very little granulated fertilizers are used when broadcasting on the surface.

_______7. Side dressing a crop with a band of fertilizer after it is growing is seldom used today to get increased yields.

_______8. It is not necessary to place the gaseous forms of fertilizer (anhydrous ammonia) below the surface of the soil while making application.

_______9. The applications of fertilizers in the fall for next spring's crop have gained wide acceptance in some areas of the country.

_______10. In the mainland states about half of the fertilizers used are applied during March, April, and May.

_______11. There are two basic types of barnyard manure spreaders.

UNIT: Fertilizers
TOPIC: Applying Fertilizer
(Topic Test continued)

_______12. Most of the limestone applied today is broadcast from trucks and trailers using the spin spreader.

_______13. In some cropping situations, the distribution of fertilizers is carried out by broadcasting from airplanes and helicopters.

_______14. The distribution of liquid fertilizers through the irrigation water is a common practice in the western states.

Topic Test
on
SOIL TYPES AND FERTILIZER USE

Student: ________________________ School: ____________________________

Date: __________________________ Score: _____________________________

Part I: Answer the following questions:

1. What are the two solid portions of the soil?

2. List the three groups of mineral particles based on size.

3. The amount of _____________, _________________, and __________ found in a soil determines its textural class.

4. Which soil particle is the smallest of the soil particles?

5. What is the purpose of the texture triangle?

6. If a soil contains __________% organic matter, it is called a muck or peat.

7. Soils in good ________________ have good aeration and contain more water than soils in poor tilth.

8. The degree of alkalinity or acidity is measured by the __________ scale.

9. The most important single influence over the availability of plant food elements to growing crops is the ______________ pH.

10. The soil in some respects is like people; it needs a ___________ checkup.

Part II: Write True beside the statements that are true and False beside the statements that are false.

_______ 1. A complete history of the field being soil tested is very helpful to the laboratory in making fertilizer recommendations.

_______ 2. Fine textured soils have a high content of sand particles.

_______ 3. The soil portion of organic soil contains between 18-95 percent organic matter.

UNIT: Fertilizers
TOPIC: Soil Types and Fertilizer Use
(Topic Test continued)

________4. A soil made up mostly of sand will not be very permeable to water, air, and plant roots.

________5. Almost all clay is crystalline.

________6. The percent of clay and soil organic matter affects the cationic exchange capacity of soils.

________7. The best returns from fertilizer are always obtained from soils that have the best physical condition for crop growth.

________8. Liming does not materially affect the soil acidity level.

________9. A pH scale has 7 as the neutral point for soil pH reaction.

________10. A soil test does not provide a scientific basis for measuring soil fertility.

________11. Iron is more available as a nutrient when the soil is acid.

________12. Soils with a pH of 8.0 are considered too acid for most plants.

________13. The soil pH neutral scale is 7.5.

________14. The soil surface is electrically charged.

________15. Ammonium ions are absorbed by the soil surface in the same manner as phosphorus ions.

________16. White (Irish) potatoes require a more alkaline soil than carrots.

________17. Cotton has a more narrow pH range than grain sorghum.

________18. A sweet soil is considered slightly acid.

________19. Soils with mostly hydrogen ions test "sweet".

________20. There are four steps in making a soil sample.

Topic Test
on
IMPORTANCE OF IRRIGATION

Student:____________________ School:____________________

Date:____________________ Score:____________________

Part I:

Write True beside the statements that are true and False beside the statements that are false:

________ 1. If a man irrigates, he should not fertilize.

________ 2. The crop grown has no relation to the kind of irrigation system used.

________ 3. Irrigation is a new practice in the United States.

________ 4. Brigham Young was the first to irrigate in North America.

________ 5. The amount of water needed depends upon the requirements of the plant to be irrigated.

________ 6. The soil has no relation to irrigation.

________ 7. The early irrigation systems used the sprinkler system.

________ 8. Every county had at least 1,000 acres irrigated in 1959.

________ 9. Methods and knowledge of irrigation have not improved.

________ 10. Many acres could be added to our tillable area if we could get water for irrigation.

UNIT: Irrigation
TOPIC: Importance of Irrigation
(Topic Test continued)

Part II:
Match the following:

1. Most of the irrigated crop area
2. Soil that holds least amount of water
3. Very thin layer of moisture around soil particles
4. Soil crumbles in palm of hand
5. Ideal balanced soil
6. Granular soil
7. Fast percolation soil
8. Slow percolation soil
9. Soil too wet, no air space
10. Has more water holding capacity

____ a. Sand
____ b. Needs water
____ c. Massive
____ d. Saturation
____ e. Crumble
____ f. Field capacity
____ g. Wilting point
____ h. Highly permeable
____ i. West Texas
____ j. Clay

Topic Test
on
SOURCES OF WATER AND PRINCIPAL METHODS OF IRRIGATION

Student:______________________ School:______________________

Date:______________________ Score:______________________

Part I:
Write True beside the statements that are true and False beside the statements that are false:

________1. All farmers should irrigate.

________2. Temperature and atmospheric conditions have no influence on irrigation.

________3. The sprinkler system is always the best.

________4. Very little subirrigation is practiced.

________5. Irrigation can be divided into three parts: delivery, application, and control of tail water.

________6. Surface water is the principal source of irrigation water.

________7. Any water is acceptable to use on plants.

________8. Sprinkler systems are used on level land only.

________9. Subirrigation is very expensive and is not widely used.

_______10. Fertilizer can be applied through sprinkler irrigation systems.

Part II:

1. The three types of sprinkler systems are ________________, ______________, and ________________.

2. The three most common methods of irrigation are ________________, ________________, and ________________.

UNIT: Irrigation
TOPIC: Sources of Water and Principal Methods of Irrigation
(Topic Test continued)

3. ________________ ________________ irrigation can be used on most soils.

4. ________________ ________________ soil is the most difficult type of soil to irrigate on the contour.

5. The water table is usually maintained between ____________ and ____________ inches.

6. Water used for irrigation usually contains less than ________________ percent of salt.

Topic Test
on
IRRIGATION MANAGEMENT

Student: ______________________ School: ____________________________

Date: ________________________ Score: _____________________________

Part I:

Write True beside the statements that are true and False beside the statements that are false:

______ 1. The cost of irrigation is prohibitive.

______ 2. Irrigation should not be tried where the annual rainfall is 30 inches.

______ 3. Subirrigation is feasible in only a few places in the United States.

______ 4. There are only a few pieces of equipment used in irrigation farming.

______ 5. Distribution of rainfall is not considered in irrigation farming.

______ 6. Grain crops wilt during the hottest part of the day if there is a need for water.

______ 7. The amount of moisture the soil contains can be determined by feel.

______ 8. The cost of operation varies with the type of irrigation used.

______ 9. All crops should receive water at the same time.

______ 10. Annual fixed costs do not depend upon the amount of investment.

Part II:

Fill in the blanks with the correct word or words:

1. Irrigated land is __________ percent more productive than nonirrigated land.
2. The soluble salts in irrigation water are ____________, ______________,

UNIT: Irrigation
TOPIC: Irrigation Management
(Topic Test continued)

and ___________________.

3. The most harmful of the above salts is ________________.

4. Gypsum supplies _________________ to the soil and aids in leaching of salts from the plant food area.

5. Sulphur, an acidifying agent, makes the alkaline soil more ______________.

6. Manure, weeds, grasses, and green manure crops add _________________ ____________________ to the soil.

Topic Test
on
IMPORTANCE OF WEED CONTROL

Student: ______________________ School: ______________________

Date: ______________________ Score: ______________________

Part I:

Write True beside the statements that are true and False beside the statements that are false:

_______ 1. Texas has one general herbicide law.

_______ 2. Plants were domesticated to serve man.

_______ 3. The annual economic loss in crop production due to weeds is estimated at $4 billion dollars in the United States.

_______ 4. Weeds serve as a habitat for insects during the winter season.

_______ 5. Weeds do not bother livestock.

_______ 6. Some weeds have a higher water requirement than some cultivated plants.

_______ 7. Weeds are no problem in a pasture.

_______ 8. Usually weeds do not interfere with the development of a domesticated plant root system.

_______ 9. A corn plant is not a weed in a cotton field.

_______ 10. Under the House Bill 402 dust form of hormone-type herbicides can be applied.

_______ 11. The use of a wind gauge is not too important when applying herbicides.

_______ 12. Persons spraying their own crops of more than 10 acres must pay a fee.

_______ 13. The violation of the Texas Herbicide Law is considered a misdemeanor crime.

UNIT: Weed Control
TOPIC: Importance of Weed Control
(Topic Test continued)

______ 14. Herbicides should not be applied if the wind velocity is more than 5 miles per hour.

Part II:
Completion

1. Weeds cause an annual loss in crop production estimated at about ____________ dollars.

2. The __________________ Department of Agriculture controls the use of herbicides in Texas counties.

3. Herbicides should be sprayed when the wind velocity is below __________ miles per hour.

4. _______________ should be kept of all spraying jobs.

5. Only a certified applicator may purchase ______________ ____________ pesticides.

Topic Test
on
CLASSIFICATION AND IDENTIFICATION OF WEEDS

Student: ______________________________ School: ______________________________

Date: ______________________________ Score: ______________________________

Part I:
Write True beside the statements that are true and False beside the statements that are false.

_______ 1. All weeds live for several years.

_______ 2. Biennial weeds are completely killed by winter cold.

_______ 3. Crabgrass is the most common perennial weed we have.

_______ 4. All weed seed fall directly to the ground from the plant.

_______ 5. Animals carry some weed seed many miles from the parent plant.

_______ 6. Man tries to control all weeds.

_______ 7. Corn, in a cotton field, is a weed.

_______ 8. The term "weed" contains many plants.

_______ 9. A bale of hay could contain thousands of weed seed.

_______ 10. Some combines should be steam cleaned after being used in a weed contaminated field.

Part II:
Completion

1. Biennials usually require ________________ years to complete their life cycle.

2. Johnson grass is known as a ____________ because it lives longer than a biennial.

UNIT: Weed Control
TOPIC: Classification and Identification of Weeds
(Topic Test continued)

3. Cocklebur and lambsquarter are classed as ____________________ (life span).

4. Hormone type herbicides are ______________ and ______________.

5. Weed seed with a parachute-like attachment are scattered mainly by the ______________.

6. The farmer spreads weed seed mainly by __________________.

7. Bermuda grass in a grain sorghum field is classed as a ______________ noxious weed.

8. Morning glory is classed as a ______________ noxious weed.

Topic Test
on
CONTROL BY MECHANICAL METHODS

Student: ______________________________ School: ______________________________

Date: ______________________________ Score: ______________________________

Part I:
Write True beside the statements that are true and False beside the statements that are false:

______ 1. All weeds can be controlled by not allowing them to produce seed.

______ 2. One of the purposes of plowing is to control weeds.

______ 3. All young seedlings have rhizomes.

______ 4. Breaking land in the fall and periodically turning the soil during the winter months helps control weeds.

______ 5. Cross cultivation does not help in weed control.

______ 6. Competitive crops are sometimes known as smother crops.

______ 7. Deep plowing is not recommended as a weed control measure.

______ 8. Plastic mulch is being used as a weed control measure.

Part II:
Completion

1. Straw mulches, building paper, and ______________ ________________ are used to control weeds in strawberries.

2. ____________________ is one of the easiest ways to eliminate and control row crop weeds.

3. Plowing in the _______________ (season) will help control perennial weeds.

4. ________________ ________________ are used to control weeds on railroads, in gullies, and along certain fence lines.

UNIT: Weed Control
TOPIC: Control by Mechanical Methods
(Topic Test continued)

5. Flame cultivation can be used to control weeds in _________________ (crop).

6. The system of destroying weeds on all sides of the plant is known as ________________________ cultivation.

7. Flooding controls weeds in ____________________ crops.

8. Weeds like _______________ and _______________ will reproduce new growth even though they have been mowed close to the ground.

Topic Test
on
CHEMICAL METHODS FOR CONTROL

Student:______________________ School:______________________

Date:______________________ Score:______________________

Part I:
Write True beside the statements that are true and False beside the statements that are false:

________1. Timing is very important in weed control.

________2. Chemicals and tillage should be used as teammates to control weeds.

________3. Herbicides are available for killing most of the weeds in our farming program.

________4. A filming agent is not needed in oil sprays.

________5. Pre-emergence treatment is not effective.

________6. Post-emergence treatment is applied after the crop plants have grown above the soil surface.

________7. Systemic weed killers are increasing in use.

________8. Contact weed killers kill by contacting the plant.

________9. Selective killers kill specific weeds.

_______10. It is always best to apply the herbicide stronger than recommended.

Part II:
Fill in the blanks with the correct word or words:

1. ______________ treatment covers the entire area or field.

2. ______________ herbicides are used before the crop or weeds emerge.

UNIT: Weed Control
TOPIC: Chemical Methods for Control
(Topic Test continued)

3. Droplets of ____________ or ____________ sprays often drift for several hundred yards.

4. ________________ is a widely used chemical to kill broadleaves on a pasture.

5. Lack of a _______________ agent causes slow absorption of dry herbicides.

6. Spray splashes and runs off ________________ leaves.

7. Weeds die when herbicide is carried to the ________________ zone.

8. The three main types of herbicides are as follows: ____________________, ____________________ and ____________________.

Topic Test
on
SAFETY

Student: ______________________ School: ______________________

Date: ______________________ Score: ______________________

Part I:

Write True beside the statements that are true and False beside the statements that are false.

_______ 1. Pesticides sold within the state must be registered only with the EPA.

_______ 2. Inhalation exposure is of the same danger with all pesticides.

_______ 3. Malathion is a chlorinated hydrocarbon.

_______ 4. There are more than twenty Centers in the state that can give specific information on pesticide poisoning and therapy.

_______ 5. Pesticide containers can be safely disposed of locally at public dumps, incinerators, or private disposal sites.

_______ 6. The proper use of herbicides is a sure way to control and destroy fungi.

_______ 7. Defoliants should be stored in the same room with insecticides.

_______ 8. 2, 4-D containers should be burned.

_______ 9. If Caution is found on the pesticide container it means the chemical is moderately toxic.

_______ 10. A pesticide labeled for general use will not cause excessive damage to the environment.

_______ 11. Cartridge respirators are used to protect against gases and dust.

_______ 12. Sevin is a carbamate chemical used for dusting or spraying.

Part II:

Completion.

1. One of the ______________ symptoms of poisoning is a headache.

UNIT: Insect and Pest Control
TOPIC: Safety
(Topic Test continued)

2. ________________ are used to repel or destroy weeds.

3. The Federal Environmental Pesticide Control Act is administered by the ______________________.

4. The two ways toxic materials enter the body are ________________ and ________________.

5. When a pesticide label is identified by the word Danger, this means that the chemical/s is ______________ toxic.

6. Chemicals in glass containers should not be stored near ________________.

7. Empty containers that were filled with noncombustible material may be destroyed in _________________________.

8. A solution of household ___________________ can be used to clean sprayers after using 2, 4-D and related chemicals.

Topic Test
on
DEFINITION AND CLASSIFICATION OF AN INSECT

Student: ____________________ School: ____________________

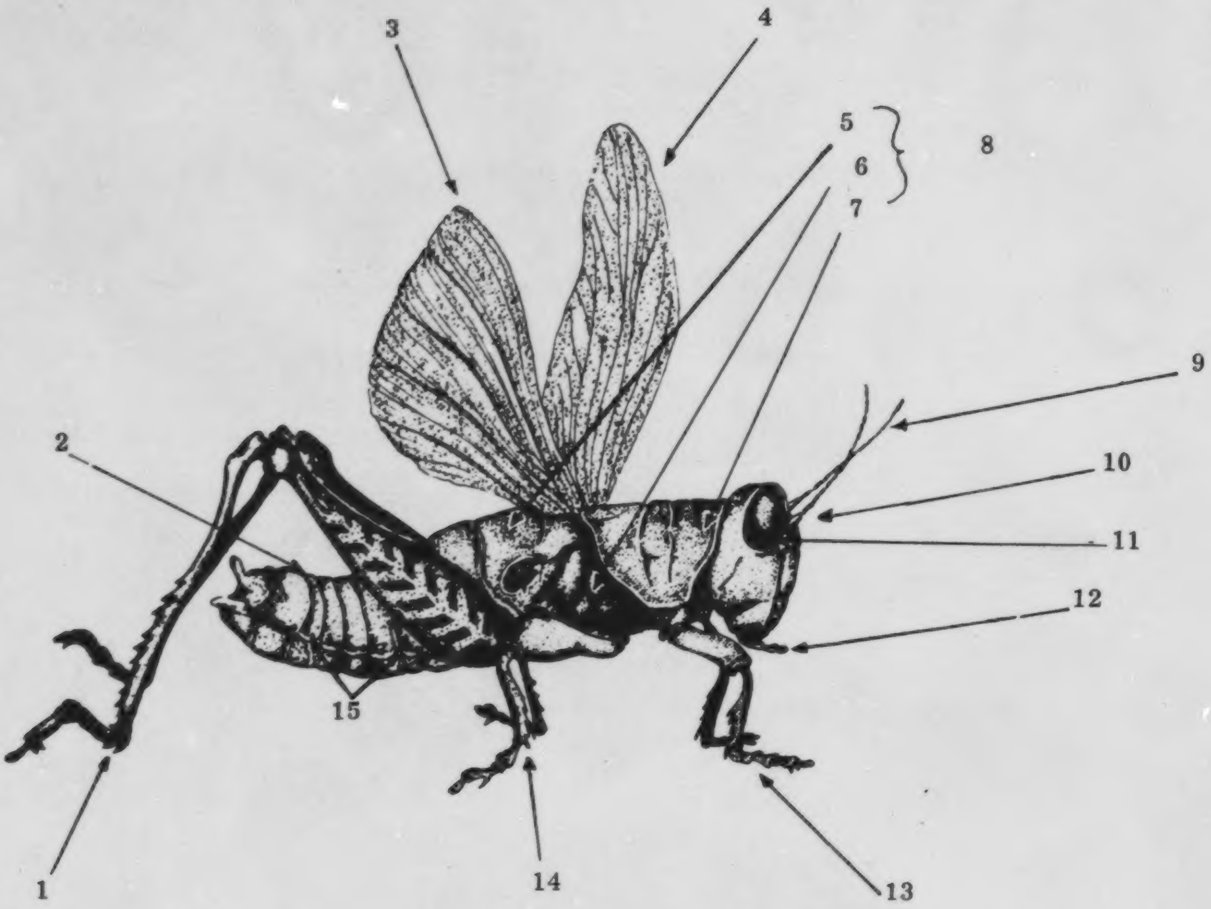
Date: ____________________ Score: ____________________

Part I:
Answer the following questions:

1. What are the two classifications of insects, according to the way they feed on plants?
2. What 6 orders of insects are most common plants?
3. Name the parts of the insect on the attached sheet.

Part II:
Completion:

1. Classify the following insects by the way they feed:
   a. Colorado potato beetle - ____________
   b. Leaf hoppers - ____________
   c. Aphids - ____________
   d. Grasshoppers - ____________
   e. Thrips - ____________
2. White grubs are classified as ____________ insects.
3. The corn ear worm is classified as an ____________ feeding insect.
4. The three beneficial capacities of beneficial insects are:
   a. ____________
   b. ____________
   c. ____________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15

"BODY PARTS OF THE INSECT"

1. ____________________
2. ____________________
3. ____________________
4. ____________________
5. ____________________
6. ____________________
7. ____________________
8. ____________________
9. ____________________
10. ____________________
11. ____________________
12. ____________________
13. ____________________
14. ____________________
15. ____________________

Topic Test
on
MANAGEMENT

Student: ______________________ School: ______________________

Date: ______________________ Score: ______________________

Answer the following questions:

1. What is insect control?

2. The two kinds of insect control are ______________ and ______________.

3. It is necessary to properly identify ______________ in order to choose the proper control procedures.

4. It has been estimated that ____________ million dollars are spent annually to control insects in the United States.

5. It cost the cotton growers ____________ million annually to control cotton insects.

6. Insects which destroy harmful insects are called ____________ insects.

7. Often bodies of ____________ will limit the natural migration of insects.

8. Early, thorough destruction of cotton stalks will result in starvation of cotton __________.

9. Imposing a quarantine on crops is a ______________ control measure.

10. Generally, the earlier the applications are made, the less ____________ the crops will suffer.

Write True beside the statements that are true and False beside the statements that are false.

______ 11. Early damage to crops by insects can affect yields.

______ 12. It is not necessary to make a field inspection to determine insect damage.

UNIT: Insect and Pest Control
TOPIC: Management
(Topic Test continued)

_______13. It is estimated that food costs in the United States would rise 10 percent if there were no insect control program.

_______14. A sudden change in temperature can destroy many insects.

_______15. The farmer relies more on chemical control of insects than any other single practice.

Topic Test
on
INSECTICIDES

Student: ______________________________ School: __________________________

Date: ________________________________ Score: ___________________________

Answer the following questions:

1. How do stomach poisons kill?
2. How do contact poisons kill?
3. How do fumigants work?
4. How much active material is usually in dust formulations of insecticides?
5. How do dust and granular formulations of insecticides differ?
6. How do dusts and wettable powders differ?
7. When should we not spray or dust due to wind conditions?
8. What are 3 methods of spraying?

Topic Test
on
DEFINITION, CLASSIFICATION OF DISEASES

Student:______________________________ School:______________________________

Date:________________________________ Score:______________________________

Write True beside the statements that are true and False beside the statements that are false:

________1. Fungi are tiny threadlike microscopic plants commonly called molds.

________2. A virus is a non-living disease producing agent so tiny that only an electronic microscope makes it visible.

________3. All nematodes are of the same genera.

________4. Nematodes are known as thread worms, roundworms, and eelworms.

________5. Crop rotation plays no part in nematode control.

________6. A pathogen is the biological agent that causes disease.

________7. Cotton root rot is caused by a virus.

________8. If the farmer cannot identify the plant disease he has no one to turn to for help.

________9. Bacteria are not important to farmers.

_______10. A good weed control program can reduce the number of insects that attack a crop and also reduce the amount of disease on a crop.

_______11. Man and farming equipment are two of the most frequent ways diseases spread.

_______12. All nematodes are plant parasites.

_______13. All plant parasitic nematodes have tiny spears on their heads.

_______14. Fungi overwinter in the soil as spores.

_______15. Fungi are probably the most important disease causing agent that affects row crops.

Topic Test
on
PRINCIPLES OF PLANT DISEASE CONTROL

Student:________________________ School:______________________________

Date:__________________________ Score:______________________________

True and False

________1. Most fungicides are bought as solids.

________2. Disease control measures have all been started in the last 100 years.

________3. In order to have a plant disease, we must have a pathogen, a susceptible host and favorable environment.

________4. Some diseases can be controlled by manipulating the environment.

________5. Any plant will act as host to any pathogen.

________6. Sulfur was used almost 3000 years ago as a fumigant.

________7. Some diseases are controlled by removing the host.

________8. Some pathogens do not affect certain hosts.

________9. Man has found a cure for all plant diseases.

Topic Test
on
CHEMICAL CONTROL

Student: ______________________ School: ________________________

Date: ________________________ Score: _________________________

Write True beside the statements that are true and False beside the statements that are false.

________1. Farmers in the corn belt are the largest regional users of pesticides.

________2. Weeds and other pests cause about $11,230,353,000 loss in the United States each year.

________3. Pest control costs about $600,000,000 each year.

________4. Seeds do not carry any diseases.

________5. Many important discoveries on disease controls have been made by accident.

________6. With our improved machines and equipment, we do not have to worry about disease control.

________7. When two or more pesticides or herbicides can be mixed together and used at the same time to control diseases and insects, they are compatible.

Topic Test
on
COTTON HARVESTING EQUIPMENT

Student: ______________________ School: ______________________________

Date: ________________________ Score: _______________________________

Part I:
Answer the following questions:

1. What percent of cotton grown in the United States is machine harvested?

2. What is the function of a cotton stripper and what type of cotton is it most adapted to harvest by this method?

3. The ____________ _______________ is a gathering mechanism.

4. The ____________ _______________ is a cleaning and conveying mechanism.

5. Name 2 classes of cotton pickers according to the method in which they are mounted.

6. Only _______________ or ___________________ rows may be harvested at a time with a cotton picker.

Part II:
Completion:

1. Cotton _________________ remove the seed cotton and burr from the stalk.

2. ______________________ in the picking unit extract cotton from the open boll.

3. More ____________ units are mounted or pulled by tractors than ____________ units.

4. The two most commonly used stripper units are the ________________ and __________________.

5. ______________ remove cotton from the spindles.

Topic Test
on
CORN HARVESTING EQUIPMENT

Student:______________________________ School:________________________________

Date:________________________________ Score:_________________________________

Complete the following statements by filling in the correct word or words:

1. __________% of corn raised in the United States is harvested for grain.

2. Weather conditions is a _______________ _______________ affecting the performance of a corn harvesting machine.

3. Both tractor-drawn and tractor-mounted pickers are powered by the ________________ of the tractor.

4. __________________ pickers are powered by their own engines.

5. When harvesting corn, either by self-propelled units or power-take off units, we should hold our travel speed down in order to save __________________.

Topic Test
on
FORAGE HARVESTING EQUIPMENT

Student:______________________________ School:______________________________

Date:______________________________ Score:______________________________

Answer the following questions:

1. What implements or equipment may be required for baling hay?

2. The ____________, _________________, and _________________ are the major parts of a mower.

3. _______________, _________________, and __________________ are classifications of hay rakes.

4. _______________, _________________, and ___________________ are different methods of conditioning hay.

5. Conditioning hay ______________ field curing by 30%, __________________ weather damage, and conserves ______________ and ____________ _________ of the hay.

6. What jobs are performed by windrowers?

7. ________________ and ________________ are used to tie bales.

8. _______________ per _____________ is the best method of measuring a baler's capacity.

9. What are the 4 processes involved in making bales with balers?

10. What is the purpose of a forage harvester (silage chopper)?

11. ______________, ________________, and _______________ are the 3 processes involved in the operation of a forage harvester.

12. ________________ has caused an increase in the use of wafering equipment.

Topic Test
on
THE COMBINE

Student:______________________ School:______________________

Date:______________________ Score:______________________

Answer the following questions:

1. Name the 16 parts in the combine and give 1 function of each. (Use picture - "Combine Operating Cycle" to name parts.)
2. List the two types of combines.
3. When was the combine first used extensively in South Texas?
4. What percent of the rice crop in Texas was harvested by combine in 1945 and 1953?
5. What machine was the forerunner of the modern combine?
6. What are the most important steps that should be observed in caring for the combine?
7. Does all the tread contact the surface of the ground on an over inflated tire?

Topic Test
on
SMALL GRAIN DRILLS AND SPIN BROADCAST SEEDERS

Student: ________________________ School: ________________________

Date: ________________________ Score: ________________________

Write True beside the statements that are true and False beside the statements that are false:

_______ 1. Mowers are designed to cut crops for hay.

_______ 2. Safety clutches are essential on mowers.

_______ 3. Mower guards protect the pitman.

_______ 4. Smooth rollers, corrugated rollers, and flail-type forage harvesters are the 3 types of hay conditioners.

_______ 5. Loose, fluffy windrows are best for hay making.

_______ 6. Wire and twine are usually used to tie hay bales.

_______ 7. All small grains are not adaptable to combine harvesting.

_______ 8. Combines may be tractor-drawn or self-propelled.

_______ 9. Only one man is needed to operate a self-propelled combine.

_______ 10. A Scourkleen is a combine attachment used for removing weed seed.

List:

11. What are the advantages for using hay conditioners?

UNIT: Harvesting Equipment
TOPIC: Small Grains
(Topic Test continued)

12. Why is a windrower used in some parts of Texas?

13. What are some reasons for baling small grains?

Topic Test
on
COTTON

Student: ____________________ School: ____________________________

Date: ______________________ Score: ____________________________

Answer the following questions.

1. From planting time until the cotton seedling comes up usually takes ________________ to ________________ days.

2. Generally cotton should be ready for harvesting ________________ days after emergence.

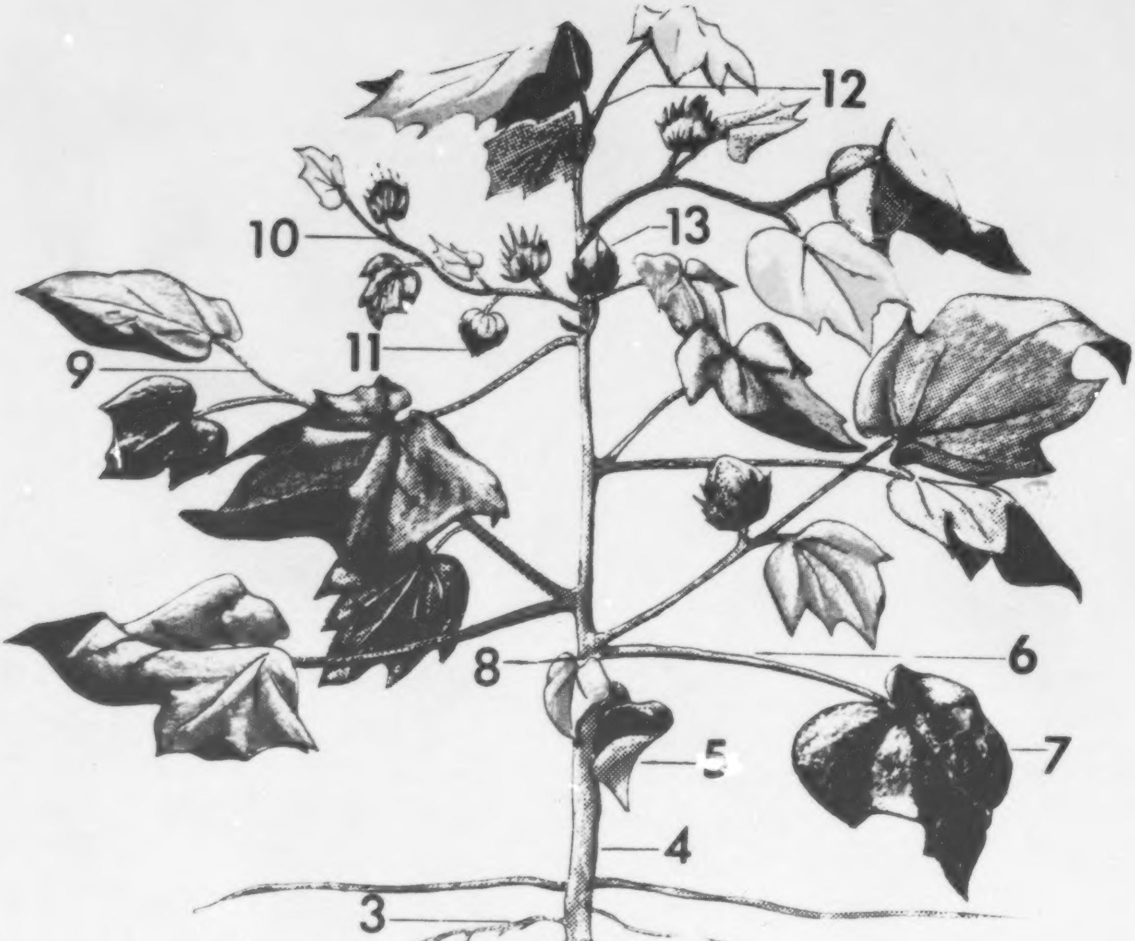
3. Cotton culture was developed in ________________ and ________________.

4. Three groups of factors to consider in selecting a variety of cotton are ____________________, ______________________, and ________________.

5. Each 500-pound bale of lint produced removes ____________ pounds of nitrogen from the soil.

6. Name the parts of a cotton plant:

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.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UNIT: Major Crops
TOPIC: Cotton
(Topic Test continued)

7. ______________________ production is possible with 24-36 inches of water per year.

8. Name 6 factors which will affect the germination of cotton seed.

9. Name 6 reasons for cultivating cotton.

10. What process is closely related to mechanical harvesting of cotton?

11. What are nematodes?

12. Root rot causes what percent of cotton loss due to diseases in Texas?

13. What 3 things determine the grade of a sample of cotton?

Topic Test
on
CORN

Student:______________________ School:________________________

Date:________________________ Score:__________________________

Answer the following questions.

1. Corn is the ____________ of grain crops in the United States.
2. The United States produces _____% of the world's corn.
3. ___________ and __________ produce 1/3 of the corn produced in the United States.
4. Most corn raised in the United States is used for ______________.
5. Ninety-five percent of the corn raised in the United States is ___________ corn.
6. What are 5 advantages of hybrid corn over open-pollinating varieties?
7. What is meant by the term "corn speaks"?
8. When are commercial fertilizers applied to corn?
9. Why did the use of corn silage become so popular and widespread?
10. Explain how silage is made.

Topic Test
on
FORAGE AND HAY CROPS

Student: ______________________ School: ______________________

Date: ______________________ Score: ______________________

Answer the following questions.

1. Name the two types of sorghums used primarily for hay and forage.
2. How does use of sorghums differ in the United States from use of sorghums in other parts of the world?
3. What should be considered in selecting a forage or grass sorghum variety?
4. What is the factor that limits successful sorghum production?
5. What are 2 methods used to propagate Bermuda grass?
6. Why should hay conditioners be used when making hay from sorghum plants?
7. What are some of the hazards of grazing sorghums?
8. Why are the giant Bermuda grasses, such as Coastal Bermuda, gaining in popularity?

Topic Test
on
GRAIN SORGHUM

Student:______________________ School:______________________

Date:______________________ Score:______________________

Write True beside the statements that are true and False beside the statements that are false:

________1. Grain sorghums have been cultivated for 4,000 years.

________2. Only cotton exceeds grain sorghum acreage in Texas.

________3. Grain sorghum in Texas is more valuable than cotton lint.

________4. Grain sorghums are actually large grasses.

________5. About 75% of the grain sorghum produced in the world is used for livestock feed.

________6. As a grain crop in the United States grain sorghums rank 3rd.

________7. As a food grain only wheat and rice exceed grain sorghums on a world-wide basis.

________8. The chief grain sorghum producing area in the United States is the southern part of the Great Plains where annual rainfall is 15-25 inches.

________9. Grain sorghums have slightly more food value than corn.

_______10. Grain sorghums will out-yield other crops on moist fertile soils.

Answer the following questions:

11. What are 3 major uses of grain sorghums?

12. What are the groups which designate most grain sorghum varieties?

13. Name 10 factors to consider when selecting a variety of grain sorghum.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Topic Test continued)

14. What is exsertion?

15. What is tillering?

16. How warm should the soil temperature be before grain sorghums are planted?

17. What is the main reason for cultivating grain sorghums?

18. What should the moisture content of grain be for safe storing?

19. How are parasitic insects beneficial?

20. Most diseases attacking grain sorghums are caused by fungi. What are the two main methods of controlling these diseases?

Topic Test
on
PEANUTS

Student: ______________________________ School: ______________________________

Date: _________________________________ Score: _______________________________

Complete the following statements by filling in the correct word or words:

1. Peanuts are native to _______________________.
2. Texas ranks _______________ in peanut production in the United States.
3. ________________________ is the leading peanut producing country.
4. The major use of peanuts in the United States is _________________________.
5. Four groups (classes of peanuts) are ___________________, ________________, ______________________, and _________________________.
6. Soil temperature should be __________________before peanuts are planted.
7. ______________________determine the amount of seed planted per acre.
8. _______________________, ________________________, and ____________________ are the basic steps to peanut harvesting.
9. Side-delivery hay rakes may be used to ___________________and ________________ peanuts.
10. ____________________ have straight teeth on the cylinder and concave bars while ____________________ have spring teeth.
11. Adding a pick-up attachment and feeder chute to a thresher makes a ______________.

Topic Test
on
RICE

Student:______________________________ School:______________________________

Date:______________________________ Score:______________________________

Answer the following questions:

1. Rice is the principal food for what percent of the world's population?
2. How does rice rank as a major field crop in Texas according to acres planted?
3. What are the groups of plant pests?
4. Rice varieties are divided into 3 groups. What are they?

Write True beside the statements that are true and False beside the statements that are false.

________5. There is practically no difference in the inside operation of a grain combine and a rice combine.

________6. The large wheels of the rice combine make it easier for the machine to cross the contour levees of a rice field.

________7. All rice combines are equipped with tracks.

________8. Self-propelled rice combines use the same size engine as self-propelled grain combines.

________9. Practically all of Texas-produced rice is harvested by combine.

________10. Most rice harvested by combine is handled in sacks.

________11. Special rice carts are used to get rice from the field to trucks.

________12. Rice, like wheat, may safely be stored as it is harvested.

________13. There are many commercial rice dryers found in the rice-producing areas of Texas.

UNIT: Major Crops
TOPIC: Rice
(Topic Test continued)

________14. Use of rice combines brought about revolutionary changes in handling the rice crop during harvesting.

Topic Test
on
SMALL GRAINS

Student: ______________________ School: ______________________

Date: ______________________ Score: ______________________

Answer the following questions:

1. Name 4 small grains.
2. What crop exceeds wheat in acreage in the United States?
3. What crop exceeds wheat in acreage in the world?
4. What 7 types of wheat are of economical importance in the United States?
5. What 7 classes of wheat are recognized in the official grain standards of the United States?
6. After planting and before harvesting, how are weeds controlled in small grains?
7. Most of the oats raised in the United States are used for what?
8. Why must we be careful in using nitrogen fertilizers if small grains are to be harvested with combines?
9. For what market is most barley raised?

Topic Test
on
COWPEAS

Student: ______________________ School: __________________________

Date: _________________________ Score: __________________________

Write True beside the statements that are true and False beside the statements that are false.

______ 1. Cowpeas are native to Central Asia.

______ 2. Texas, South Carolina, Georgia, Oklahoma, and North Carolina have 75% of the acreage planted to cowpeas in the United States.

______ 3. Cowpeas are self-pollinated legumes.

______ 4. A bushel of cowpea seeds should weigh 50 pounds.

______ 5. Good forage and seed yields can be obtained from infertile soils when nitrogen fertilizers are applied.

______ 6. Cowpea planting seed should be inoculated with nitrogen-fixing bacteria if no crops having these organisms have been raised on the soil recently (4-5 years).

______ 7. Cowpeas should not be planted later than 90 days before the first frost of the fall.

______ 8. Using cowpeas for swine pastures is commonly known as "hogging off".

______ 9. Catjang cowpeas and asparagus beans are subspecies of the cowpea group and of little economic value in the United States.

______ 10. The average yield per acre for cowpeas is 9 bushels per acre.

Topic Test
on
SOYBEANS

Student: ______________________________ School: ______________________________

Date: ______________________________ Score: ______________________________

Write True beside the statements that are true and False beside the statements that are false:

________1. Soybeans are less resistant to drought than corn.

________2. Soybeans are more resistant to frost than either corn or cowpeas.

________3. The reason there are so many different soybean varieties is because commonly grown varieties are limited to local areas and not broad areas.

Complete the following statements by filling in the correct word or words:

4. The ____________________ is the leading soybean producing country in the world; ______________________ is second.

5. Soybeans should have at least a ________________ month growing season.

6. Average yield for soybeans in the United States is _______________ bushels per acre.

7. ____________________ the speed of the cylinder of the combine will help keep seed cracking and splitting to a minimum.

8. Soybeans should not be stored until the moisture content is ________% or less.

Topic Test
on
ALFALFA AND CLOVER

Student:______________________ School:______________________

Date:______________________ Score:______________________

Answer the following questions:

1. Alfalfa is known as the "______________ of the forages".

2. Alfalfa is a ______________ billion dollar crop in the United States.

3. Name 5 uses for alfalfa and sweet clovers.

4. Why is nitrogen not a major nutrient for alfalfa?

5. What are 4 characteristics of good-quality alfalfa hay?

6. ______________ of alfalfa seed is a good practice before planting.

7. Alfalfa responds better to a soil with a pH between ________ and ________.

8. The two most destructive diseases found in alfalfa production are: ______________ and ______________.

9. If the pH of the soil is below 6.0, it can be raised by adding ______________.

10. Sweet clover is a good soil conditioner. ______________ is added to the soil if the seeds are properly inoculated.

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Answer Sheet to Test
on
OPPORTUNITIES IN FARMING

Part I

1. Agriculture
2. 6,000,000
3. 240
4. Increasing
5. Decreasing
6. Four
7. Fertile
8. Diseases and insects
9. 25
10. a. Production
    b. Supply
    c. Processing
    d. Forestry
    e. Ornamental horticulture

Part II

1. True
2. True
3. False
4. False
5. False
6. False
7. True
8. True
9. True
10. False

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Page 8

Answer Sheet to Test
on
HISTORY OF FARMING

1. True
2. False
3. False
4. True
5. True
6. True
7. True
8. True
9. False
10. False
11. False
12. True
13. True

Answer Sheet to Test
on
FARMING AS A SCIENCE

1. The science or art of cultivating the soil, producing crops, and raising livestock
2. Ten
3. Fifty
4. Horse or animal power with tractor power
5. Herbicides
6. Decline
7. Fertilizer
8. Twenty
9. Season
10. Increase
11. Horticulture
12. DDT
13. Weed control, defoliants, and hybrid cotton

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Page 9

Answer Sheet to Test
on
ECONOMICS OF A FARM ENTERPRISE

Part I:

1. True
2. False
3. True
4. False
5. False
6. True
7. True
8. False
9. True
10. True
11. False

Part II:

1. Underdeveloped
2. Scarcity
3. Product
4. Developing
5. Factories
6. Railways
7. 1887

Answer Sheet to Test
on
FARMING IN THE UNITED STATES

1. False
2. True
3. False
4. True
5. False
6. True
7. False
8. False
9. True
10. True

Answer Sheet to Test
on
FARMING IN TEXAS

1. False
2. True
3. True
4. True
5. False
6. False
7. False
8. True
9. False
10. True

Answer Sheet to Test
on
FARMING ORGANIZATIONS AND FARM SERVICE AGENCIES

Part I:

1. Farm prices, farm credit, roads, schools, and health programs
2. a. Home
   b. Church
   c. School
3. Legislation, education, and cooperation
4. Five
5. 1926

Part II:

1. False
2. False
3. False
4. True
5. True
6. False
7. True
8. False

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Page 9

Answer Sheet to Test
on
KEEPING FARM RECORDS

1. False
2. False
3. True
4. False
5. False
6. False
7. False
8. True
9. True
10. True
11. False
12. False
13. False
14. True
15. False

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Page 11

Answer Sheet to Test
on
USING RECORDS IN FARM MANAGEMENT

Part I:

1. False
2. True
3. False
4. True
5. True
6. False
7. False
8. False

Part II:

1. If a crop is destroyed by hail, wind, or water, it is necessary for the farmer to know when, and what herbicide was used before he plants a second crop.
2. Less time is devoted to plowing out point or short rows: (Tractors and equipment can be operated more efficiently).
3. C. For profit
4. E. All of the above

Answer Sheet to Test
on
PROPER USE OF MACHINERY AND EQUIPMENT

Part I:

1. True
2. True
3. False
4. True
5. False
6. True
7. False
8. True
9. False
10. False
11. True
12. False
13. True
14. False
15. False
16. False
17. False
18. False
19. True
20. False

Part II:

1. Old ladder leaning against barn, nails in board, trash in entrance, and loft door hanging loose.
2. Standing under tree when spraying.
3. Working over tractor belt.
4. Pitchfork lying on ground.
5. Cutting wood on unguarded saw.
6. Ax with broken handle.
7. Child playing in water trough.
8. Working under tractor with "makeshift" jack support.
9. Adjusting mower in front of sickle - tractor running.
10. Lifting heavy objects.
11. Children riding tractor and equipment.
12. Cutting tree on house and powerline.
13. Old barbed wire fence in pasture.
14. Rake lying in yard.
15. Leading bull without stick on ring.

Answer Sheet to Test
on
MAINTENANCE OF POWER MACHINERY

Part I:

1. True
2. True
3. False
4. True
5. False
6. True
7. True
8. False
9. False
10. True
11. False
12. True
13. True
14. False
15. False

Part II:

1. The entire length of the lowest tread bar is in contact with the ground and free of buckling.
2. Liquid weighting increases traction. The fill (water) should be about 75 percent of the air space.
3. a. Air cleaner assembly
   b. Oil levels and grease connections
   c. Cooling system
   d. Electrical and ignition systems
   e. Fuel and fuel system
4. a. Pulley and sprocket wheels should be the proper size.
   b. Belts and chains should have proper tension at all times.
   c. Equipment should be checked for sprung shafts,
   d. Condition of belt or chain should be checked periodically.

Answer Sheet to Test
on
MAINTENANCE OF EQUIPMENT

1. True
2. True
3. True
4. False
5. False
6. True
7. True
8. True
9. True
10. True
11. False
12. True
13. True
14. True
15. True

Answer Sheet to Test
on
MAINTENANCE OF FARM STRUCTURES AND EQUIPMENT

1. True
2. False
3. True
4. True
5. True
6. True
7. False
8. False
9. True
10. False
11. True
12. False
13. True
14. False
15. False

Answer Sheet to Test
on
BUILDING AND MAINTAINING FARM FENCES

Part I:

1. False
2. True
3. True
4. True
5. False
6. False
7. False
8. True
9. True

Part II:

1. Woven, wire, barbed wire, and electric
2. Fourteen and 12 1/2 gauge
3. Aluminum - Galvanized
4. 3,000
5. 3 1/2
6. Shorter

Answer Sheet to Test
on
IMPORTANT FACTORS AFFECTING THE CHOICE OF CROPS

Part I:

1. False
2. True
3. False
4. True
5. True
6. True
7. False
8. False
9. True

Part II:

1. Two
2. a. Crop use and market
   b. Climate
   c. Soil
   d. Cost of production
   e. Labor and machinery
3. Pure line
4. Geneticists
5. Pedigree

Answer Sheet to Test
on
IMPORTANCE OF A GOOD SEEDBED

Part I:

1. False
2. True
3. False
4. False
5. True
6. True
7. True
8. True
9. True
10. True

Part II:

1. Root hairs
2. Nematocides
3. Decomposed
4. a. Moisture
   b. Temperature
   c. Weeds

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Answer Sheet to Test
on
ROW CROP SEEDBED PREPARATION

1. False
2. True
3. True
4. True
5. False
6. True
7. False
8. False
9. False
10. True
11. False
12. True
13. False
14. True
15. False

Answer Sheet to Test
on
BROADCAST CROP SEEDBED PREPARATION

Part I:

1. False
2. True
3. False
4. True
5. False
6. False
7. True
8. True
9. False
10. True

Part II:

1. Wheat
2. One-way
3. Broadcast
4. Clay
5. Dry
6. Disking
7. Disking
8. Harvested

Answer Sheet to Test
on
PERMANENT PASTURE PREPARATION

1. False
2. True
3. True
4. True
5. False
6. True
7. True
8. False
9. True
10. False
11. True
12. True
13. False
14. False
15. True

Answer Sheet to Test
on
LANDMANAGEMENT PRACTICES

Part I:

1. Soil Conservation Service
2. Vegetation
3. Runoff and erosion
4. Land plane and carry-all scraper
5. Sixty-seven
6. Nine
7. Tile
8. Open ditches

Part II:

1. True
2. True
3. True
4. True
5. False
6. True
7. True
8. False

Answer Sheet to Test on INTRODUCTION

1. In 1842
2. 1850
3. Baltimore, Maryland
4. 22,097,000
5. In South Carolina, 1868
6. False
7. True
8. False
9. True
10. True
11. False
12. True
13. True
14. False
15. True

Answer Sheet to Test
on
PLANT NUTRIENTS AND THEIR FUNCTIONS

1. Primary, secondary
2. Secondary
3. Nitrogen
4. Potash
5. Nitrates or ammonia
6. Phosphorus, potash
7. Limestone
8. True
9. True
10. False
11. True
12. False
13. True
14. True
15. False
16. False
17. False

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Answer Sheet to Test
on
TYPES OF FERTILIZERS
(ADVANTAGES AND DISADVANTAGES OF EACH)

1. True
2. True
3. True
4. False
5. True
6. False
7. True
8. False
9. False
10. True
11. False
12. True
13. True
14. True
15. False

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Page 15

Answer Sheet to Test
on
APPLYING FERTILIZERS

1. False
2. True
3. True
4. False
5. True
6. False
7. False
8. False
9. True
10. True
11. True
12. True
13. True
14. True

Answer Sheet to Test
on
SOIL TYPES AND FERTILIZERS

Part I:

1. Mineral matter, organic matter
2. a. Sand
   b. Silt
   c. Clay
3. Sand, silt, and clay
4. Clay
5. To find the textural class name of a soil
6. 18
7. Tilth
8. pH
9. Soil
10. Periodic

Part II:

1. True
2. False
3. True
4. False
5. True
6. True
7. True
8. False
9. True
10. False
11. True
12. False
13. False
14. True
15. True
16. False
17. True
18. False
19. False
20. False

Answer Sheet to Test
on
IMPORTANCE OF IRRIGATION

Part I:	Part II:
1. False	2 a.
2. False	4 b.
3. False	8 c.
4. False	9 d.
5. True	7 e.
6. False	5 f.
7. False	3 g.
8. False	6 h.
9. False	1 i.
10. True	10 j.

Answer Sheet to Test
on
SOURCES OF WATER AND PRINCIPAL METHODS OF IRRIGATION

Part I:

1. False
2. False
3. False
4. True
5. True
6. True
7. False
8. False
9. True
10. True

Part II:

1. Portable, semiportable, and stationary
2. Sprinkler, border, and furrow
3. Graded-border
4. Light sandy
5. 12 and 24
6. 0.5

Answer Sheet to Test
on
IRRIGATION MANAGEMENT

Part I:

1. False
2. False
3. True
4. False
5. False
6. True
7. True
8. True
9. True
10. False

Part II:

1. Fifty
2. Calcium, magnesium, and sodium
3. Sodium
4. Calcium
5. Neutral
6. Organic matter

Answer Sheet to Test
on
IMPORTANCE OF WEED CONTROL

Part I:

1. False
2. True
3. True
4. True
5. False
6. True
7. False
8. False
9. False
10. False
11. False
12. True
13. True
14. False

Part II:

1. Four billion
2. State
3. Ten
4. Records
5. Restricted use

Answer Sheet to Test
on
CLASSIFICATION AND IDENTIFICATION OF WEEDS

Part I:

1. False
2. False
3. False
4. False
5. True
6. True
7. True
8. True
9. True
10. True

Part II:

1. Two
2. Perennial
3. Annuals
4. 2, 4-D and 2,4, 5-T
5. Wind
6. Machinery
7. Primary
8. Secondary

Answer Sheet to Test
on
CONTROL BY MECHANICAL METHODS

Part I:

1. False
2. True
3. False
4. True
5. False
6. True
7. True
8. True

Part II:

1. Plastic sheets
2. Cultivation
3. Fall
4. Flame throwers
5. Cotton
6. Cross
7. Rice
8. Dandelions and thistles

Answer Sheet to Test
on
CHEMICAL METHODS FOR CONTROL

Part I:

1. True
2. True
3. True
4. False
5. False
6. True
7. True
8. True
9. True
10. False

Part II:

1. Broadcast
2. Pre-emergence
3. 2, 4-D or 2, 4, 5-T
4. 2, 4-D amine
5. Wetting
6. Waxy
7. Root
8. Liquid, granular and gas

Answer Sheet to Test
on
SAFETY

Part I:

1. False
2. False
3. False
4. True
5. True
6. False
7. False
8. False
9. False
10. True
11. True
12. True

Part II:

1. Mild
2. Herbicides
3. EPA
4. Oral and dermal
5. Highly
6. Heat
7. Incinerators
8. Ammonia

Answer Sheet to Test
on
DEFINITION AND CLASSIFICATION OF AN INSECT

Part I:

1. Chewing insects
   Sucking insects
2. Coleoptera
   Hemiptera
   Lepidoptera
   Orthoptera
   Homoptera
   Thysanoptera
3. (1) Hindleg
   (2) Abdomen
   (3) Hindwing
   (4) Forewing
   (5) Metathorax
   (6) Mesothorax
   (7) Prothorax
   (8) Thorax
   (9) Antenna
   (10) Head
   (11) Eye
   (12) Palpae
   (13) Foreleg
   (14) Middle leg
   (15) Spiracles

Part II:

1. a. Chewing
   b. Sucking
   c. Sucking
   d. Chewing
   e. Sucking
2. Subterranean
3. Internal
4. a. Improve soil
   b. Pollenize plants
   c. Destroy harmful insects

Answer Sheet to Test
on
MANAGEMENT

1. The killing, repelling, and interfering with the feeding and propagation of insects.
2. Natural and artificial
3. Insects
4. $704
5. $100
6. Beneficial
7. Water
8. Insects
9. Legislative
10. Damage
11. True
12. False
13. False
14. True
15. True

Answer Sheet to Test
on
INSECTICIDES

1. Stomach poisons are digested by the insect. They kill by action on or absorption from the digestive system.
2. Contact poisons kill by being absorbed through the insect's skin or body wall and acting on his nervous system.
3. Fumigants kill by entering the insect's body through the tracheal system.
4. Dust usually has from 0.1 to 25 percent active material.
5. Dust and granular formulations differ in size of particle.
6. Wettable powders are meant to be mixed with water and as wettable powders have up to 75 percent active materials while dusts are meant to be used as dust and do not have over 25 percent active material.
7. Spraying should be done when the wind is blowing less than 15 miles per hour. Dusting should be done when the wind speed is less than 5 miles per hour.
8. Three ways of spraying are:
   a. Aerial
   b. Machine surface
   c. Hand surface

Answer Sheet to Test
on
DEFINITION, CLASSIFICATION OF DISEASES

1. True
2. True
3. False
4. True
5. False
6. True
7. False
8. False
9. False
10. True
11. True
12. False
13. True
14. True
15. True

Answer Sheet to Test
on
PRINCIPLES OF PLANT DISEASE CONTROL

1. True
2. False
3. True
4. True
5. False
6. True
7. True
8. True
9. False

Answer Sheet to Test
on
CHEMICAL CONTROL

1. True
2. True
3. True
4. False
5. True
6. False
7. True

Answer Sheet to Test
on
COTTON HARVESTING EQUIPMENT

Part I:

1. 75%
2. Strippers are designed to harvest stormproof or semi-stormproof cotton varieties. The plants are usually less than 30 inches tall. Because stripping is a once over operation, harvesting is delayed until most bolls are opened.
3. Roller stripper
4. Finger stripper
5. a. Tractor attachment
   b. Self-propelled
6. 1 or 2

Part II:

1. Strippers
2. Spindles
3. Stripper than picker
4. Roll and line
5. Doffers

Answer Sheet to Test
on
CORN HARVESTING EQUIPMENT

1. 90
2. Miscellaneous factor
3. PTO (Power take off)
4. Self-propelled
5. Corn

Answer Sheet to Test
on
FORAGE HARVESTING EQUIPMENT

1. a. Mowers
   b. Rakes
   c. Conditioners
   d. Windrowers
   e. Balers
2. Frame, cutter bar assembly, mower drive
3. Side-delivery, dump, sweep
4. Crushing, crimping, flailing
5. Speeds, reduces, color, feed value
6. Mowing, raking, conditioning
7. Wire, twine
8. Bales -- minute
9. a. Pickup
   b. Feeding
   c. Compressing
   d. Baling
10. To chop field crops and place the chopped crop in a wagon
11. Cutting and feeding, chopping, blowing
12. Feedlot feeding

Answer Sheet to Test
on
THE COMBINE

1. a. Reel - Momentarily holds crop against guards
   b. Knife - cuts stems and sweeps cut material onto platform
   c. Platform auger - delivers cut grain to feeder
   d. Feeder - carries cut grain to cylinder
   e. Cylinder - grain is removed from head
   f. Concave grates - passes through these two
   g. Cylinder beater - strips cylinder
   h. Finger grates - separates loose kernels of grain from straw
   i. Straw rack - continues separation of grain from straw and removes straw from combine
   j. Cylinder beater check flap - regulates flow of material over straw racks
   k. Chaffer - removes small straw and chaff from grain
   l. Grain pan - catches grain separated at concave cylinder beater grate and returned from straw rack
   m. Shoe sieve - final cleaning of grain
   n. Grain trough - catches cleaned grain before it is carried to grain tank
   o. Cylinder fan - provides wind for cleaning grain
   p. Auger trough - catches unthreshed grain, etc. for return to cylinder and rethreshing
2. a. Tractor drawn
   b. Self-propelled
3. 1943
4. 60 to 70 percent in 1945 and 98 percent in 1953
5. McCormick reaper
6. a. Lubrication
   b. Care when not in use
   c. Inspecting and testing parts for wear
   d. Ordering and replacing parts
7. No

Answer Sheet to Test
on
SMALL GRAIN DRILLS AND SPIN BROADCAST SEEDERS

1. True
2. True
3. False
4. True
5. True
6. True
7. False
8. True
9. True
10. True

11. Advantages are:
    1. Drying time in the field is reduced
    2. Risk of weather losses is reduced
    3. Color and vitamins are not destroyed
    4. Field losses due to shattering are lessened

12. Reasons for using windrowers include:
    1. When grain is ripening unevenly
    2. When there are a lot of weeds in a field
    3. When the grain doesn't dry properly
    4. When stalks are green but grains are dry
    5. When there is a threat of or loss of crop due to weather

13. Reasons for baling:
    1. No combines available
    2. Hay is needed for winter feed more than grain.
    3. No grain storage facilities are available.
    4. Not enough grain in the field to pay for combining
    5. Grain is of poor quality
    6. There is a lot of straw but very little grains.

Answer Sheet to Test
on
COTTON

1. 7, 10
2. 160
3. India, America
4. Plant characteristics, fiber properties, seed components
5. 70
6. 1. Tap root
   2. Root hair (feeder roots)
   3. Lateral root
   4. Stalk (main stem)
   5. Cotyledonary node and cotyledons (seed leaves)
   6. Main stalk leaf petiole
   7. Main stalk leaf blade
   8. Main stalk node (joint)
   9. Vegetative branch (leaf only)
   10. Fruiting branch (leaves alternating with fruit)
   11. Square (floral bud)
   12. Terminal bud
   13. Young boll
7. Normal
8. a. Soil moisture
   b. Temperature
   c. Viability of seed
   d. Firmness of the soil
   e. Type of seed (fuzzy or delinted)
   f. Seed treatment
9. a. Destroy weeds
   b. Loosen the soil
   c. Permit better aeration of the soil
   d. Permit better penetration of water into the soil
   e. Promote decomposition of soil organic matter
   f. Increase crop yields
10. Defoliation
11 Microscopic, soil-inhabiting worms
12. 25.53 %
13. Color, leaf, preparation

Answer Sheet to Test
on
CORN

1. "King"
2. 50
3. Iowa, Illinois
4. Livestock feed
5. Dent
6. a. Better quality grain and forage is produced
   b. Higher yields
   c. More resistance to diseases and insects
   d. More drought tolerant
   e. Adapted to a wider area
7. The term "corn speaks" is used to indicate the characteristic symptoms of the corn plant when essential nutrients are not adequately available to the plant.
8. Fertilizers may be applied
   a. Prior to planting
   b. At time of planting
   c. As side dressing to growing crop
   They may be applied at one or more of the above times.
9. Use of corn silage became popular and widespread because;
   a. It is highly palatable.
   b. Few nutrients are lost when corn is stored in this manner.
   c. There is little waste in feeding.
   d. Silage can be made when weather is unfavorable to fodder curing.
   e. Less storage space is required for silage than for fodder.
10. Steps in making silage include:
    a. Chopping the crop into small lengths
    b. Placing and packing crop in a silo
    c. Fermentation of the crop
       (1) Respiration of the green chop and aerobic bacteria (oxygen trapped is used and carbon dioxide released) (oxygen is used in 4-5 hours--carbon dioxide increases for 48 hours)
       (2) Temperature increases for 15 days then slowly decreases.
       (3) Aerobic organisms are killed.
       (4) Acids are formed from fermenting sugars and carbohydrates.
       (5) Silage develops sour taste, peculiar odor, different color.
       (6) Acid content increases until bacteria and enzymes are killed.

When the acid content rises to the point that bacteria and anxymes are killed, the silage process is completed. Under proper conditions (airtight) silage may be stored for many years.

Answer Sheet to Test
on
FORAGE AND HAY CROPS

1. Forage sorghums, grass sorghums
2. In the United States, sorghums are used mainly for livestock and poultry feeds, while in other countries, it is primarily a human food.
3. a. Adaptability
    b. Time required to mature
    c. Drought resistance
    d. Disease resistance
    e. Resistance to lodging
    f. Height
    g. Yield
    h. Use
4. Moisture
5. a. Seed
    b. Vegetative sprigs
6. Sorghums have thick, juicy stems and do not cure (dry) quickly without the use of hay conditioners. By using conditioners, this curing time is reduced by several days and the possibility of damage by unfavorable weather conditions is greatly reduced.
7. When grazing sorghum, animals may suffer prussic acid poisoning, if they are allowed to graze the sorghum just after it has started growing. After a stress, such as a drought or freeze, this is especially true of Johnson grass.
8. The giant Bermuda grasses are popular because they will produce more total tonnage of forage than will other grasses.

Answer Sheet to Test
on
GRAIN SORGHUM

1. True
2. False
3. True
4. True
5. False
6. True
7. True
8. True
9. False
10. False
11. Three major uses of grain sorghums are:
    a. Feed for livestock
    b. Human food
    c. Industrial uses
12. Major groups which designate grain sorghum varieties are:
    a. Milo
    b. Kafir
    c. Feterita
    d. Hegari
    e. Sorgo
13. (Any 10 of these 12) Factors to consider in selecting a variety of grain sorghums are:
    a. Compact or loose head
    b. Exsertion
    c. Lodge resistance
    d. Uniform height
    e. Head drying
    f. Tillering
    g. Size of seed
    i. Drought resistance
    j. Insect and disease resistance
    k. Even-maturing
    l. Threshing quality
    m. Grazing quality
14. Exsertion is the distance the stalk extends above the last leaf to the head of a grain sorghum plant.
15. Tillering is the growing of secondary ("sucker") heads by a grain sorghum plant.

UNIT: Major Crops
TOPIC: Grain Sorghum
(Answer Sheet continued)

16. 70°F
17. The main reason for cultivating grain sorghums is to control weeds.
18. 12%
19. Parasitic insects lay their eggs in the larvae and eggs of harmful insects. As these eggs hatch, they feed on the eggs and larvae of the harmful insects, killing them.
20. Most fungi diseases are controlled by:
    a. Seed treatment
    b. Use of resistant varieties

Answer Sheet to Test
on
PEANUTS

1. Brazil
2. Second
3. India
4. Oil production
5. a. Virginia
   b. Runner
   c. Spanish
   d. Valencia
6. 75° F.
7. Moisture conditions
8. a. Digging
   b. Shaking
   c. Threshing
9. a. Windrow
   b. Shake
10. a. Threshers
    b. Pickers
11. Peanut combine

Answer Sheet to Test
on
RICE

1. 60%
2. 5th
3. a. Pathogens
   b. Predators
   c. Weeds
4. a. Long-grain
   b. Medium-grain
   c. Short-grain
5. True
6. True
7. False
8. False
9. True
10. False
11. True
12. False
13. True
14. True

Answer Sheet to Test
on
SMALL GRAINS

1. a. Wheat
   b. Oats
   c. Barley
   d. Rye
2. Corn
3. Rice
4. a. Common wheat
   b. Durum wheat
   c. Club wheat
   d. Poulard wheat
   e. Polish wheat
   f. Emmer wheat
   g. Spelt
5. a. Hard red spring wheat
   b. Hard red winter wheat
   c. Soft red winter wheat
   d. Durum wheat
   e. Red durum wheat
   f. White wheat
   g. Mixed wheat
6. Weeds in small grains are controlled by using selective herbicides.
7. Livestock feed
8. The rapid growth of the plants in response to nitrogen make tall, weak stems and more lodging will take place.
9. Malt market

Answer Sheet to Test
on
COWPEAS

1. False
2. True
3. True
4. False
5. False
6. True
7. True
8. True
9. True
10. True

Answer Sheet to Test
on
SOYBEANS

1. False
2. True
3. True
4. a. United States
   b. China
5. Five
6. 24
7. Reducing
8. 14

Answer Sheet to Test
on
ALFALFA AND CLOVER

1. Queen
2. 1 1/2
3. a. Hay
   b. Pasture
   c. Silage
   d. Seed
   e. Soil improving crop
4. Alfalfa can take nitrogen from the air.
5. a. Fine stemmed
   b. Leafy
   c. Green
   d. Free from foreign materials
6. Inoculation
7. 6.5 and 7.0
8. Bacterial wilt and leaf spot
9. Lime
10. Nitrogen